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Production and Price Policy in Public Enterprise

By Marcus Fleming

FORMULATION OF THE " RULE "

It is perhaps necessary to apologise for prolonging a controversy which has already occupied so much space in the economic periodicals. I do so because what has been called the Hotelling-Lerner theory of marginal cost pricing seems to me to have received, in the course of that controversy, more than its due share of buffeting (though, as the sequel will show, I am not blind to its defects), and because I hope to be able to broaden somewhat the area of agreement among economists.

First, let me attempt to formulate the Hotelling-Lerner " Rule " of optimal output in the most general and least ambiguous way :

" *Assuming that the prices of factors and of products are such as to bring demand and supply into equilibrium an optimal position will result from each enterprise undertaking any changes of input and/or output such that the value of additional outputs less the value of subtractional outputs exceeds the value of additional inputs less the value of subtractional inputs.*

In valuing additional (or subtractional)[1] output in the above formula the price which has to be employed is neither the price which would prevail in the absence of the change, nor the price which would prevail in the event of the change, but the mean price over that part of the demand curve for the product which corresponds to the addition (or subtraction) in question ; similarly the price used in evaluating additional or subtractional input is the mean price over that part of the supply curve of the factor which corresponds to the addition (or subtraction) in question."

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[1] If anyone should quibble at the use of the word "subtractional" in this formula, I would refer him to the definition of " uglification " in *Alice in Wonderland.*

From the above formulation the following points emerge :

(*a*) The Rule in its pure form relates *not to pricing but to production.* This is of great importance and is constantly being overlooked. Prices should be determined by demand and supply. It is only where circumstances forbid the integral application of the Rule, and even then only in certain cases, that the question of costs (marginal or other) enters directly into the determination of price.

(*b*) The various marginal rules about which controversy has centred, e.g., that the value of marginal product should equal the factor price, or that the marginal substitutability of factor for factor should equal their relative prices, are but special applications of a general rule which is equally applicable to large input/output variations, such as that involved in setting up an entire new plant. This point may require a little amplification. The smaller the increment of input or output which we are considering relative to the size of the market for the factor or product in question the less important becomes the price alteration which such an increment will entail. For infinitesimal variations the pre-variation price, the mean price, and the post-variation price coincide. Where, however, the variation is significantly large[1] it would be erroneous to value the additional output at the post-variation price without adding in the surplus accruing to consumers as a result of the additional output. And it would be erroneous to value additional input at the post-variation price without subtracting the surplus accruing to factor suppliers as a result of the additional input.

(*c*) The input/output variations covered by the Rule are not necessarily simultaneous but may affect inputs and outputs occurring at various times in the more or less distant future. To compare the values of such increments it is of course necessary to discount them by the aid of an appropriate interest rate to the moment at which the decision as to the desirability of the variation has to be taken. With this interpretive gloss it is clear that the rule governing investment is precisely the same as that governing current production. The difference between investment inputs and current inputs is merely that the former involve more discounting of future values (and also are more apt to involve significant indivisibility) than the latter.

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[1] The fact that the price alteration brought about by even a very small increment of output will probably exercise a significant effect upon the revenue of the enterprise whose output has altered (unless the demand for the output of that enterprise is infinitely elastic) does not imply that the price alteration will have a significant effect on the valuation of the output increment itself.

(*d*) The Rule, as formulated above, provides a criterion for determining which of two alternative positions is the better. It does not provide a means for determining which alternatives are available. If the production function is continuous, blind obedience to the Rule will lead, by a gradual approach, to the optimum. Otherwise management will have to determine the alternatives with the aid of its technical knowledge and imagination.

(*e*) Where input/output variations involving large increments are in question, the Rule, as formulated, assumes the independence of the various product demand curves and factor supply curves. When some of the products and/or factors affected are either substitutable for or complementary to others it becomes necessary, before one can determine a unique set of product demand curves and factor supply curves to conceive of the increments as if they occurred in a certain order. As the order changes, so will the curves shift *but it is immaterial to the outcome of the calculation which order is chosen.* As has been pointed out, for special cases, by Meade[1] and Henderson,[2] when the products and/or factors of different plants are substitutable or complementary it may be impossible to consider large input/output variations in any given plant in isolation from what is happening in the other plants. It becomes necessary to consider alternative *combinations* of input/output situations in the various plants simultaneously, i.e., as if they were alternative input/output situations in a single plant. These alternatives can then be compared with the aid of demand and supply curves determined as above. The complication, however regrettable, is inseparable from the problem of optimisation under the assumed conditions.

MODIFICATIONS OF THE RULE

It will be generally admitted that, before the Rule can be applied in practice, certain modifications are required either because conditions logically presupposed by the Rule in its pure form do not exist in reality, or because account has to be taken of aims of policy other than those which the Rule is designed to achieve.

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[1] J. E. Meade: "Price and Output Policy in State Enterprise", *Economic Journal*, Dec. 1944.

[2] A. M. Henderson: "The Pricing of Public Utility Undertakings", *The Manchester School*, September 1947.

A. *Imperfect Competition.* One well known modification is that required to offset the imperfection of competition in the private enterprise sector. Since, in most branches of production, output is not carried to the point beyond which the value of additional factors would exceed the value of additional output, the prices of employed factors will in general fail to reflect the full value of marginal productivity. In order to avoid an excessive diversion of resources towards socialised industries, production there too should stop somewhat short of the point at which the value of additional output equals the value of the corresponding additional factor cost. The management of each socialised industry should behave as though a rather complex sort of tax had been imposed on its production. The *ad valorem* incidence of this " tax " would vary, not only as between socialised industries, but even between the different products produced, and the different factors employed, by a given industry. It would depend partly on the average margin of exploitation (excess of value of marginal product over price) of each factor of production in industries competing for such factors with the socialised industry in question, and partly on the average margin of exploitation (excess of price over value of marginal factor) of products competing with or complementary to each of the products of the socialised industry in question. But the estimation involved in the calculation of such a tax would be hazardous and complicated in the extreme. Probably the best that could be done in practice would be to make a rough estimate of the average margin of factor-exploitation throughout industry and apply a corresponding uniform " tax " to all socialised enterprises.

B. *Collective Bargaining.* A second important cause of distortion in factor prices, justifying a modification of the Rule in its application to public enterprise, is the determination of wage rates by collective bargaining. The main defect of wage rates so determined from the pricing standpoint is not so much that the relative wage rates in different occupations fail to respond in the long run to the trends of demand and supply, as that they are insufficiently flexible in the short run, both as between different types of labour and for the same type of labour as between different regions. Evidence for this is furnished by the co-existence of labour shortages in some places and trades with unemployment in others. From the standpoint of income stability this may be justifiable. It nevertheless tends to vitiate cost calculation both in the public and private sectors of industry.

The ideal solution, from the pricing standpoint, would no doubt be for the state openly to tax to an appropriate extent the employment of scarce labour and subsidise to an appropriate extent the employment of surplus labour, both by private and public industry. Given the practical and political difficulties of this, however, it is difficult to escape the conclusion that socialised industries employing as they do large numbers of men, and constituting the principal purchasers of certain types of labour in certain localities, should depart from the strict application of the Rule in such a way as to reduce unemployment and economise the use of scarce labour. They should treat surplus labour as if it had a wage rate lower than, and scarce labour as if it had a wage rate higher than, the actual rates. This policy, however, should not be carried to the point at which it will eliminate the unemployment or scarcity entirely, otherwise the incentive to desirable labour transference may be unduly weakened.

C. *Price Stability*. The system of optimal production in its strict form implies that prices will be allowed to float freely in response to demand and (optimally adjusted) supply. But changes in the basic factors both on the demand and on the supply side may give rise to substantial price fluctuations. If the product is stockable these fluctuations may conceivably be mitigated by accurate speculation, itself applied in accordance with the rules of optimisation. But if some of those who are in a position to exercise a powerful influence on the market are led, by the price fluctuations, to embark on inaccurate speculation, the effect of their operations, and of those of the professional speculators who batten on them, may be to accentuate the fluctuations. The greater these fluctuations the more frequent will be the miscalculations by consumers and producers alike, and fear of such miscalculation may lead consumers to buy less and producers to produce less, than would be desirable. In cases where the product is not stockable, e.g., transport services, the determination of price from day to day on the basis of equating demand and supply would lead to fluctuations so rapid as to disorganise the mechanism of payment, besides inflicting inconvenience upon the consumers. For these reasons, it will be justifiable to introduce a higher degree of stability into the prices of the products of socialised industries than would be consistent with a strict application of the Rule.

There are three principal techniques which may be employed, separately or in combination, for this purpose:

(i) Buffer-stocking;
(ii) Variable shortage;
(iii) Variable output.

Buffer stocking in the sense in which that expression is here employed, entails accumulating or drawing on stocks, even at times where this would not be profitable or in accordance with the Rule, for the purpose of preventing prices from falling or rising too far or too fast. The diseconomy in this practice consists in (*a*) a non-recurrent utilisation of resources in the initial building up of stock, and (*b*) a distribution in time both of production and consumption which entails excessive costs of storage. If exclusive reliance is placed on buffer stocking, the price or price range for any period will have to be set sufficiently high to ensure that stocks are unlikely to be exhausted at any point within the period. Subject to this it should be such as to leave stocks at the end of the period at an optimal level. This criterion is, however, open to the objection that, while it ensures price stability within the price-fixing period, it may result in considerable jumps in price from one period to the next. It is possible, therefore, that a better result would follow from the less exacting criterion that the price or price range be adjusted at intervals whenever the buffer stock appeared to be rising or falling too much or too fast. This would lead to price changes in the same direction as, but more frequent and less abrupt than, those resulting from the first criterion.

The second technique, which I have called "*variable shortage*," consists in fixing the price low enough to prevent demand from ever falling short of supply (as determined by the Rule). The degree of shortage, i.e., the excess of demand at the fixed price over supply, will vary in the course of the period, the variation being lessened, however, to the extent that the demand is capable of postponement.

The disadvantages of this system are:

(*a*) A general tendency towards underproduction and hence underconsumption owing to the fixed price being below the average level of the optimal price for the period; and

(*b*) maldistribution of supply resulting from the shop shortages, or more or less arbitrary allocation systems necessitated by the maintenance of an artificially low price. These disadvantages will be the less severe the more elastic and postponable is the demand.

The optimal level for the fixed price under this system will be the highest compatible with the maintenance of *some* degree of shortage throughout the price-fixing period.

Techniques (i) and (ii) may be so combined that over part of the period for which price is fixed supply exceeds current demand and stocks are accumulated, while over another part of the period demand exceeds supply even when the latter is swollen by stock decumulation. The problem of determining the appropriate fixed price under this system is too complicated for its elucidation to be justifiable here, having in mind the slight practical importance of the case. The higher the price the higher will production—and possibly consumption—be over the period as a whole, and the more will consumption be postponed from times of excess supply to times of shortage. The optimal point will be reached when the advantages of eliminating shortage are balanced by the disadvantages of excessive carrying of stock.

The third technique, that of *variable output*, is to fix a price and adjust output in such a way as to satisfy whatever demand is forthcoming at that price.

Technique (iii) is employed in service industries where storage is physically impossible and when shortage is precluded either by a common carrier legal obligation or by its great inconvenience, as in "load shedding" of electric current. Since output is determined by demand, the level of production over the period for which price is fixed will be the higher the lower is the price fixed. The appropriate level for the fixed price can be determined by an adaptation of the Rule for optimal production. The price should be reduced to the point beyond which, for any further reduction, the value of the anticipated additional output—as determined by demand—would begin to fall short of the value of the additional factor costs. Where the production function is continuous this is equivalent to saying that price should be fixed at a level equal to the value of anticipated marginal factor cost. It is interesting to note that this formulation —which is perhaps the formulation of the marginal rule most frequently employed, particularly by opponents of the " marginal " rule—is really appropriate only to cases where prices have to be fixed for a period of time, i.e., only to cases in which, as has been shown, some departure from the strict rule is necessarily involved, and only a *relative* optimisation is possible. The Rule in its strict form determines, not price, but production.

When the Rule has to be adapted in this way in the interests of price stability the question at once arises : *which* factors enter into consideration in computing the additional—or marginal—factor costs ? The answer depends on the length of time for which it is intended that the price shall remain fixed. The choice of price will affect directly the demand (and hence output) for that period only, and the input variations with which we are concerned are those which are associated, or are capable of being associated, with these output variations. Even so defined, however, the concept of marginal cost has blurred edges. There will be a choice of input variations corresponding to any given output variation. Some of the possible input variations may include " investment " items, the effect of which on output will not be exhausted within the pricing period. That is to say, output variations outside the pricing period as well as input variations both inside and outside the pricing period may be associated with that output variation which—since it depends directly on the price variation we are considering —may be termed the " basic " variation. It is only the basic variation which necessarily falls within the pricing period.

It would, of course, be a great convenience for the purpose of calculating the appropriate price under this system, if the longer term input/output variations could be ignored. This is an argument for shortening the pricing period. For the shorter the pricing period the less bearing will the current price-fixing operation have on the desirability of incurring any particular capital outlay, and the greater will be the proportion of investment decisions which can be taken independently of that operation. These investment decisions can then be taken as *data* and prices can be fixed for the current period on the basis of additional costs of a relatively short-period character.

The three techniques of price stabilisation need not be applied in isolation. Indeed some combination of under-production and stocking to prevent undue price falls and overproduction, destocking and shortage to prevent undue price increases would probably represent, at least in theory, the least uneconomic way of achieving price stability, though it might prove somewhat difficult to apply in practice.

D. *Income Distribution.* So far we have been concerned exclusively with the function of price as a signpost and incentive to optimal output. But, of course, price has a second function—that of influencing the distribution of income and wealth. In principle this might require considerable modification of rules based exclusively on the incentive aspect of pricing. Such modifications might tend in the direction of:

(*a*) producing more than the Rule would require of types of goods or services which are predominantly consumed by the poorer classes;

(*b*) utilising to a greater extent than the Rule would require factors of production predominantly supplied by the poorer classes or by those whose relative standard of living is falling; or

(*c*) discriminating in the price charged or paid to consumers or producers respectively, between the relatively well- and the relatively ill-to-do.

Policies (*a*) and (*b*) are, of course, open to the objection that they distort the intercommodity distribution of demand and supply. Very probably the desired effect on income distribution could be obtained with less damage to incentives by direct taxes and subsidies.

Apart from this rather banal point, there is another distributional consideration which it has been alleged ought to enter into the determination of the prices of publicly produced goods and services. Coase argues[1] that to run socialised enterprises at a loss, as might be required in certain cases by an application of the rules of optimal pricing and production would involve some inequity as between consumers of different classes of goods, since those consuming the products of the enterprises in question would be subsidised at the expense of the rest of the community. I do not deny the political difficulties, to which Henderson also alludes,[1] which might arise out of such a state of affairs. But, while questions of equity are not very amenable to proof, I can see no *a priori* reason why the distribution of income which would result from equating prices with marginal cost (with the various modifications discussed in the preceding pages) should be regarded as any less (or more) ideal than that which would result from equating prices with average costs, or indeed from any other pricing principle that can be imagined. If one takes, as the criterion of ideality in distribution, correspondence to individual needs (equalisation of marginal utilities of income to all individuals), then there is nothing to choose between the distribution of income resulting from the marginal cost principle and that resulting from the average cost principle. In both cases the inter-personal distribution of income is an incidental by-product of a process of price determination which is not at all designed with an eye to distributional considerations. Of course if, like Coase, one postulates an initial position in which price covers average cost *and distribution of income is nevertheless ideal*, then admittedly any disturbance of that ideal distribution such as would tend to result from the adoption of the marginal cost principle would by definition be for the worse. But—to move a step or two closer to reality—if the initial position does correspond to an ideal distribution it can only be because methods of fiscal policy are used to correct the imperfections in income distribution which would otherwise result from the crude impact of the average cost principle of pricing. And, in this event, the same techniques would presumably be available to remove the imperfections of income distribution which would result from the crude impact of the marginal cost pricing principle.

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[1] Coase: "Price and Output Policy of State Enterprise: A Comment", *Economic Journal*, April 1945.

CRITICISMS OF THE OPTIMAL PRINCIPLE

I shall now consider a number of criticisms which have been or might be advanced against the principles of optimal production and pricing set forth in the foregoing pages. In a sense, of course, the various modifications already discussed can be regarded as having been made in response to valid criticisms of the principles in their " pure " form. But they are modifications of—I hope—a non-controversial character which become necessary as soon as one relaxes the abstract assumptions on the basis of which the Rule was originally formulated. The criticisms discussed below, on the other hand, are attacks on the Rule as such—or the particular modification of it known as the " Marginal Cost " principle—and argue, explicitly or implicitly, in favour of some alternative principle of pricing. It is a weakness of a good deal of the argumentation levelled against the Rule that the alternative, by comparison with which it is deemed inferior, is not clearly stated.

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[1] *Loc. cit.*

Usually, critics of the Rule appear to have in mind as alternatives either

(*a*) the " average cost principle " whereby a uniform price is charged for the product, equal to the average cost of production, and hence sufficient to ensure that aggregate receipts cover total costs, or

(*b*) some sort of two-part (or multi-part) tariff whereby, in addition to a unit price being charged on the actual service, consumers are also made to pay a charge or charges for being allowed access to the service at all, or for being supplied with installations essential to the receipt of the service.

Neither of these alternative criteria, however, will suffice, without some supplementary principle or convention, to determine any particular scale or method of production. Consider first the " average cost principle ". Suppose that a firm, applying the Rule without any of the complications which we have introduced in the previous section of this paper, finds that it is failing to cover its aggregate costs: there are various ways open to it (without having resort to multi-part tariffs) of reducing its losses. For example, it might restrict output and input generally, thus provoking a rise in the price of its products and a fall in the price of its factors. Or it might, while keeping output constant, substitute factors in elastic supply for factors in inelastic supply, thus securing a fall in the price of the latter more than sufficient to offset the rise in the price of the former.

Assuming that the firm is in a position, by the fullest exercise of monopolistic and monopsonistic powers, to earn a revenue more than sufficient to cover total costs, there will be an infinite number of alternative positions open to it, any one of which would satisfy the average cost criterion. Supplementary conventions are therefore required to give precision to the rule.

The system of two-part or multi-part pricing does not pretend to the same precision as does the average cost principle with uniform prices. Sometimes when the system is advocated all that is meant is that, if any costs are imputable to the provision of a particular consumer with access to a service (e.g., electric power), but are *not* variable with the amount of the service (e.g., current) provided, the consumer should pay a special charge, to cover the cost incidental to his having access to the service, and a second charge based on the amount of the service consumed. Interpreted in this sense, the system is not merely compatible with the principles which we have been expounding but, if access to the service is provided to all consumers who demand it, is even required by those principles. If this point has been thus far ignored in the present exposition, and if most expositions of the marginal cost principle say nothing about it, the reason simply is that most formulations of that principle have been worked out on the basis of a production function in which factor input varies with output, irrespective of the number or character of the consumers among whom that output is divided. This is done for the sake of simplicity. As soon as the principle is established for those simpler conditions it is time to turn to more complex possibilities.

If we now assume a production function for a particular enterprise such that factor input varies with (*a*) aggregate output and (*b*) number of consumers, it becomes indispensable to have two prices, one for output and one for consumers (or, more exactly, one for the privilege of being served as a consumer). Consumers would then pay a price per unit of output consumed equal to the value of the additional input required by the last unit of output, and a price for being served at all equal to the value of the additional input involved in providing the last consumer with access to the service. Of course, even this is a relatively simple type of production function. If specific cost items are imputable to the service of specific consumers, then, of course, these specific consumers should pay these specific costs.

Even when costs are unaffected by the number or nature of the consumers it may be *compatible* with the principles advocated here, though no longer *required* by them, to apply a two-part or multi-part tariff. Strictly speaking, the prices which are relevant to discussions of optimal pricing and production are merely the prices of *marginal* output and input or, more exactly, of output or input the occurrence of which cannot be taken for granted but depends on the price or production criteria adopted. Intra-marginal output or input is such in virtue of the fact that, at optimal uniform prices it yields a producers' or consumers' surplus, and no harm can ensue, from the standpoint of incentive, if a supplementary charge is made to tax away these surpluses. The difficulty is to find a basis and a rate for such charges which will not result in some consumer being charged more than the amount of his surplus and thus deterred from purchasing the intra-marginal output altogether.

THE " FISCAL " OBJECTION

Consider, now, in the light of these prefatory remarks, various criticisms of the " Rule " and first of all the " fiscal " objection. The essence of this objection is that if the Rule is applied in its integrity most, if not all, of the socialised industries will have to work at a level of output entailing profits lower than those which would have been earned had the industry remained in private hands, and quite probably less than those on the basis of which compensation paid to previous owners has been assessed. This will involve the Exchequer in losses which will have to be financed by additional taxes. These taxes, however levied, are bound to have disincentive effects on effort and enterprise. This point was raised by James Meade and answered by me in a symposium in the *Economic Journal*.[1] On that occasion too much attention was paid by both of us, as I now think, to the question of whether the industries would be operating under conditions of increasing or diminishing costs. This has really very little to do with the matter, if it is granted that compensation is based on the " net maintainable revenue " under private ownership. Whatever the cost curve of the industry, it will be generally true that public enterprise, applying the rules of optimisation in their absolute form, will tend to expand output beyond the point which would be favoured by private enterprise operating under conditions of imperfect competition, and will therefore earn less profits. When, however, we take account of Modification A discussed at page 4 above, and suppose that the public authorities apply the rule in its relative form, the problem loses a great deal of its importance. Only in so far as the industry to be socialised has been applying a degree of restriction greater than that applied generally in industry will the advent of public enterprise entail expanded output and reduced profits. Assuming, however, for the sake of argument, that there is some residual tendency for the application of the rule to lead to failure to cover compensation charges, I adhere to the argument which I formerly advanced against Meade, namely, that it is, in general, less harmful to incentives to finance this loss by, say, a general tax on consumption, than by causing the price of the products of the socialised industry to exceed the value of their marginal factor costs.

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[1] " Price and Output Policy of State Enterprise ", *Economic Journal*, Dec. 1944.

Admittedly, the picture is complicated by the fact that no tax can be completely general in its incidence. Even the income tax fails to touch leisure. Under such circumstances there might be a case for a special tax on the products of a particular nationalised industry if the demand for its products were particularly inelastic so that only a comparatively slight maldistribution of resources would be required to achieve a given tax revenue. This, however, is a special case.

INCENTIVES TO MANAGERIAL EFFICIENCY

Wilson, and to a lesser extent Coase, have made much of the point that, if the managers of plants in a socialised industry are instructed to work according to our criterion of optimisation, it becomes impossible to judge of the relative merits of different managers by their relative success in earning profits. Moreover, they cannot be paid according to the profits they earn. For both these reasons their incentive to operate their plants in a technically efficient way is less than if pay and promotion depended on their success in earning profits.

To this there are a number of counter arguments. In the first place, where the output of the individual plant is small relative to the size of the market, local managers may be instructed, in conformity with the Rule, to attempt to maximise their respective profits in full and free competition with each other. In these circumstances, the objection raised clearly would not apply. If, however, the output of the individual plant is large, relative to the market for the products of the industry, a different procedure will have to be followed. One possibility is for the central board to lay down prices for the individual plants and instruct the local managers to adjust production so as to maximise profits at these prices, which would themselves be adjusted from time to time so as to make demand equal to supply. Here again the profit criterion of managerial efficiency is just as applicable as in private enterprise.

There may, however, be cases where the influence of the output of the individual plant on the price of its product is too considerable to be either ignored or overcome by central price fixing or where such price fixing is impracticable, e.g., because of the multiplicity of types and qualities of product. In these cases the managers of the individual plants may have to be trusted to control output and price directly in accordance with the optimal principle. Here, admittedly, profits can no longer be regarded as an indication of managerial efficiency or made a basis of remuneration. But, in this respect, the optimal criterion is no worse than the usual alternative of basing price on average costs. This is particularly obvious if, as may well happen under this criterion, each plant is instructed to fix its prices in such a way as to cover its own costs *plus* a certain uniform rate of profit. But even if some more refined interpretation is adopted, which is satisfied if the costs of the industry as a whole are covered, the problem remains, since plants cannot in any event be instructed to maximise profits. In theory there is a third alternative, namely, two-part pricing combined with profit maximisation, which might provide the best solution of all if it were possible to discriminate perfectly in applying the standing charge to different customers, but this is usually impossible.

So far as industries of this type are concerned, we seem to be up against the dilemma either of instructing managers to maximise profits at the cost of permitting some undue restriction of output, or else of instructing managers to apply the Rule, thus forfeiting the advantages of having a profit criterion for managerial efficiency.

Let us look more closely at these alleged advantages. In the first place, even under private enterprise, working under competitive conditions, physical differences between plants make it impossible to measure the relative efficiency of managers by comparing the profits they are able to earn in their respective plants. Still less can it be measured by comparing the profits earned by different managers from the same plant at different times. If profits are to be used at all as a test of managerial desert, they cannot be the profits actually earned but rather the profits which would have been earned with certain *assumed* prices and technical conditions, which must be the same for all plants. These hypothetical profits may, of course, be arrived at by a series of allowances and adjustments starting from the profits actually earned.

Now precisely the same methods could be applied to test the efficiency of managers operating in accordance with the Rule. True, these managers are not trying to maximise profits. Nevertheless, the Rule prescribes behaviour which would in fact maximise profits if prices were independently fixed by the market. The level of profits at assumed prices will, therefore, provide some indication of a manager's success in adhering to the Rule, provided that the prices assumed for accounting purposes are not too far distant from current market prices. Inter-plant comparisons of managerial efficiency can then be made, with no greater likelihood of error than if managers had in fact been trying to maximise profits, by adjusting actual profits so as to arrive at what profits *would have been* with fixed prices and technical conditions the same for all plants.

My conclusion on the problem of managerial efficiency and selection of managers under public enterprise is that the difficulties that have been raised have much less substance than would at first sight appear.

Difficulties of Applying the Rule

It is frequently contended that the difficulties of measuring " additional cost " impose a considerable if not an insuperable obstacle to the practical application of our proposed criterion of optimisation. In considering this criterion, it is particularly important to bear in mind :

(*a*) that the matter has to be judged on a comparative basis, as between alternative criteria, and (*b*) that the Rule does not profess to be a rule about *price* but about production, and that it leaves price to be determined on the good old-fashioned principle of equating demand and supply.

To apply the Rule successfully management must (*a*) seek to determine the precise differences between alternative factor/product combinations and (*b*) evaluate these differences. Difficulties admittedly arise at both stages. Take stage (*a*). Not only is a difference always more difficult to estimate to a given degree of accuracy than the absolute magnitudes from which it is derived, but a given increment in the output of one of the products of an enterprise may affect the factor input or the output of other products of the enterprise at a multitude of points, and often in rather intangible ways. Thus, the increase of a particular traffic on the railways might involve not merely an increase in the labour force or the use of rolling stock, but a greater risk of accidents or more frequent hold-ups in other forms of traffic. Or again, the utilisation of plant in excess of its normal capacity may entail shortage of spares and risk of production delays due to the breakdown of machinery. Henderson has pointed out how user cost may complicate the calculation.[1] All these difficulties must be granted, though it should be observed that they equally confront a firm trying to maximise its profits under competitive conditions.

It is, however, when the Rule is employed, despite all warnings, as a pricing principle—i.e., when the problem is posed in the form of a decision not as to whether the scale or method of production should be altered, but as to whether the selling price should be altered—that the greatest difficulties arise. For it is always in some degree uncertain what the effect of a given price change on the volume of demand and production will be, so that the problem is one of determining the differences between magnitudes which are themselves uncertain. Moreover, if the enterprise in question is operating in the vicinity of full capacity with steeply rising marginal cost curves, a slight error in estimating the effect of price on demand may result in a big difference in additional cost, owing, e.g., to the necessity for incurring additional investment. It must be repeated, however, that these horrors need be encountered only (*a*) if the amenities of price stabilisation are deemed to outweigh the undoubted diseconomies associated with it, and (*b*) if circumstances preclude the adoption of methods of price stabilisation other than the technique which I have termed Variable Output.

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[1] A. M. Henderson: "Prices and Profits in State Enterprise", *Review of Economic Studies*, No. 39, 1948–49.

Stage (*b*), the evaluation of input/output increments, raises further difficulties, particularly, as Coase and Wilson have emphasised, where bulky inputs and outputs are concerned, e.g., where it is a question of extending capacity. In such a case, as we have seen, the management would be obliged, in order to evaluate additional inputs and outputs correctly, to hasard estimates regarding the demand curves of the products and possibly also the supply curves of the factors. Moreover, even after the investment has taken place, there is no way of determining whether it has been justified or not. It is feared, therefore, that these conditions will tempt management to indulge its alleged penchant for over-investment and that, since this danger will be at its greatest when investment decisions are made by local managers, it will be necessary, in spite of other disadvantages, to refer such decisions to the central board of the nationalised industry.

Now all these are very weighty criticisms. But, before coming to the conclusion that they outweigh the theoretical merits of our criterion, it is well to see whether some of them do not apply equally to the alternative criteria. For example, the difficulties in evaluating bulky input and output increments are by no means overcome by adopting the average-cost principle. Thus the installation of a new plant might be justified, under that very vague criterion (*a*) if, considered separately, it was expected to earn enough net revenue to cover its interest and amortisation, or, alternatively (*b*) if it was expected to add sufficiently 'without raising prices'[1] to the net revenue of the industry as a whole, to cover its own interest and amortisation. Actually each of these interpretations is itself vague and indeterminate. But it can be seen that, however the first interpretation is defined, it must involve estimating *ex ante* the manner in which the prices of the products and complementary factors of the new plant will be affected by the bringing into operation of that plant—just as the optimal criterion does. The only difference is that, whereas the average-cost criterion involves estimating the prices that will prevail on the hypothesis that the new plant *is* installed, the ideal criterion takes an average between these prices and the prices which would prevail if the plant were *not* installed. Under the second interpretation of the average-cost criterion, the need for estimating demand and supply elasticities is actually greater than with the optimal criterion. For it may often happen that probable reduction in prices as a result of bringing the new plant into operation is negligible from the standpoint of evaluating the additional output and input, but by no means negligible from the standpoint of its effect on the net revenue of the industry as a whole. On the other hand it must be admitted that *ex post* one can usually see whether the average-cost criterion, however interpreted, has been satisfied while that is often more difficult in the case of the optimal criterion.

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[1] *Cf.* A. M. Henderson, *Review of Economic Studies*, No. 39.

The other source of difficulty—that of estimating associated output and input increments—is by no means avoided by adopting either the average-cost criterion or the maximum-profit criterion. The average-cost criterion is, of course, indeterminate and a great deal depends on the precise way in which it is defined. In a broad sense, it is undoubtedly easier to determine the general scale of production by the average-cost criterion than by the additional-cost criterion. All that is required is to expand production when profits are above a certain level and to contract production when they are below that level. But, as soon as any attempt is made to reconcile that criterion with some approximation to economy in production, the familiar difficulties arise. Thus if any *given* scale of output is to be produced at minimum cost, it is necessary to bring the marginal products of the various factors into line with the relative prices of these factors. Again, if a proper balance is to be held between alternative products, their relative selling prices must be brought into line with their relative marginal costs. Indeed, if we were to attempt to define the average-cost criterion in such a way as to do the least possible damage to incentives, we should end up with a formula considerably more complicated and more difficult to apply than the straightforward optimal criterion—one containing all the difficulties of measuring associated increments and a few more of its own.[1]

In practice the average-cost principle is usually applied in a more or less arbitrary way. Each distinguishable product in a multi-product industry is so priced that expected receipts from that product will cover its specific costs of production and a conventionally determined share in the non-specific costs. Output of the various products is determined by the demand at the prices thus arrived at. This solution gets round the difficulties of measuring associated input/output increments except so far as factor substitutions are concerned: these continue to be determined on marginalist lines, e.g., in such a way as to minimise money costs.

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[1] I hope to give a fuller treatment of this point in a separate article.

It cannot be denied that it may often be easier to determine the level of output by this method than by applying the Rule. On the other hand, the diseconomies involved may be serious. An increase in the demand for a product, which ought to be held in check, for the time being at least, by an increase in price, will be allowed to lead to the overstraining of existing capacity, or to the product in question becoming scarce, with all the inconveniencies which scarcity entails. Still more serious, a decline in the demand for the product, instead of being held in check by a fall in the price, will probably be encouraged by a *rise* in the unit cost and price and may well lead to unemployment and waste of capacity. Where, as often happens, the products of an industry are mutually substitutable (e.g., different forms of transport, products from different regions or plants in the same industry, different grades of coal, etc.), the average-cost principle thus interpreted may lead to unbalance with the industry, e.g., to an uneconomic geographical distribution of supply. In all probability these diseconomies will be so glaring that an attempt will be made to depart to some extent from the arbitrary conventions of cost allocation. A nationalised railway system, for example, will be tempted to soften the rigours of the "cost-of-service" principle by some consideration for "what the market will bear". Or else a distinction may be drawn between current costs which have to be covered by price and long-term costs which need only be covered over a period of years, thus giving some scope for price flexibility.

As soon as the average-cost principle has to be diluted in this way, it loses its only advantage over the Rule—that of simplicity. Thus, for example, the attempt to cover fixed costs "over a period of years", if taken seriously involves calculations of incredible complexity. Decisions regarding the scale of current output are made dependent on forecasts of future prices and costs and are quite needlessly subjected to the uncertainties which, under a more rational system, would be confined to investment decisions. As to attempts to mix the "average-cost principle" with vague "commercial" considerations, the result can only be confusion and scepticism as to the existence of any valid economic principle of pricing.

It is impossible to strike a balance between such heterogeneous arguments. I believe the superiority of the average-cost principle over the Rule in respect of applicability is seldom as marked as is generally supposed, and is frequently non-existent. In some cases the rough and ready simplicity of the average-cost criterion may justify its use despite the drawback that it is not, in fact, aimed at the optimum. But in the majority of cases it is apt, if applied uncritically, to lead into a labyrinth of fallacies. Those who believe in the sovereign merits of price stability will feel naturally drawn to the average-cost criterion, and indeed, if prices have to be frozen anyhow for years at a time on the basis of long-term rather than short-term marginal cost, any additional diseconomy involved in basing them on average rather than marginal costs may well be secondary.

Unfamiliarity of the Rule.

Quite the strongest argument against the Rule, in my view, is simply that it is unfamiliar to the man in the street and fails to command his assent. This might be thought to be merely a transitional difficulty. If people have got accustomed to the idea that price should cover average cost might they not in the same way come to acquiesce in the Rule even if they never quite understand it? The analogy is questionable. Most people regard prices not primarily as sign-posts for production and consumption but as factors which determine incomes and the purchasing power of incomes. Their natural tendency is to regard these prices as right which bring about a "fair" and "just" distribution of real incomes. If the idea that product prices should be related to costs has nevertheless won a measure of acceptance it is because countless generations of private trading and production have accustomed people to the idea that a failure of price to cover costs will lead to catastrophe, bankruptcy, unemployment and the like. True the arguments of economists have added strength and colour of justification to this lesson of experience and have tended to discredit ideas of "fair" and "just" prices. But it is asking much of lay docility to expect it to absorb on the strength of economic theory a new-fangled doctrine which establishes an esoteric rule for public enterprise other than that which prevails for private enterprise.

The question whether the Rule will win public support gains its importance partly in relation to collective bargaining and partly in relation to political pressure of organised producer or consumer groups who supply factors to or buy products from the socialised industry. The conception that a socialised industry must cover its costs may exercise a restraining influence on the wage demands of organised labour and on the pressure of consumers for cheap prices. Workers would not so willingly accept the argument that if wages were raised the socialised enterprise, acting in accordance with a "highbrow" rule, would have to restrict output. (And indeed if the rule were applied with the allowance for social cost as suggested earlier, no such restriction of output and employment need follow.) Nor would consumers willingly see prices raised and supplies restricted in accordance with an unfamiliar rule. Once it was admitted that it might be right for a socialised industry to make a loss there is a danger that it would be subjected to pressures from both sides and the final result might be less economic than the average-cost rule would have been.

CONCLUSION

I shall not attempt a final weighing-up of the arguments for and against the Rule. Psychological and sociological factors enter into the reckoning, on which economists may well differ. I, myself, believe that it never pays in the end to propitiate an economic fallacy, and that the mental confusion engendered by following a false principle will have worse practical consequences than the difficulties encountered in understanding and applying the true one. But I shall be content if I have demonstrated that some of the arguments advanced against the Rule in recent years, particularly those of the "practical" variety, have been decidedly overdone.

London.

The Price Policy of Co-operative Societies

By B. S. Yamey

Within the co-operative movement in Great Britain there are considerable differences of opinion about the type of price policy that is appropriate for its purposes and in its present circumstances. The following observations on co-operative price policy are not intended primarily as a contribution towards current controversies. Rather, the treatment takes the form of an attempted analysis of the 'economics of the firm', the firm in this case being a co-operative retail society. It is believed that the results, even though they are derived from an analysis that abstracts from complications that are important in practice, may assist in clarifying the nature of some current problems, if not of their ideal solution.

I

In the next Section some terms are explained. This is followed (Sections 3 to 7) by a consideration of price policy in situations where consumers regard the dividends they receive merely as price-reducing rebates. This unrealistic assumption is made to illustrate some consequences of the practice of 'open membership', which is a feature of co-operative enterprise; and also to extend the analysis to include societies (not necessarily retail societies) in which the payment of dividends to consumers is an unimportant feature of co-operative business. The unrealistic assumption is then dropped. Various possible objectives of price policy are examined in Sections 11 and 12. In Section 13 the effects of the widespread policy of maintaining, or of attempting to maintain, an established rate of dividend are examined. Finally, a brief appendix touches upon some 'welfare' aspects of co-operative price policy.

2

In the discussion it will be assumed that the costs of operation of a retail society conform to the usual pattern, so that a U-shaped (long-run) average cost curve represents the cost conditions under which the society operates. In practice the expansion of the output of a retail society takes the form of additions to the number of selling points serving the society's members, and/or additions to the range of merchandise handled. The rising average costs, after the technical optimum (with minimum average costs) has been passed, may be explained in terms of increasing costs of co-ordination and supervision after the organisation has reached a certain size and complexity.[1]

There is considerable difficulty in defining, let alone in measuring, the 'price' at which a society, or any retail establishment, sells its retailing services. It is the gross margin(s) that is(are) added to the buying prices of the merchandise it handles; the price of its services is not the selling prices of the merchandise. However, for convenience of expression, the latter prices, expressed as an average 'price', will be referred to when dealing with price policy. The definition of the 'output' of a retail establishment presents equal difficulty. The 'output' is not the volume of its sales, either in value or in physical terms, but is the volume of the services it dispenses. The difficulties of defining output, whilst important in other contexts, are not considered here; and for convenience 'output' is equated with sales volume.

The excess of the gross receipts earned over the expenses of operation is called the 'surplus', which, after additions to reserves and contributions by the society for educational and charitable purposes, is periodically returned to members in the form of a dividend, calculated on the basis of the value of members' purchases made during the particular period. The term 'gross price' will be used to denote the price charged to members in the first instance, that is, at the time of sale. The term 'net price' will be used to denote the balance when the dividend is deducted from the 'gross price'. Thus the 'net price' is equal to the average cost of operation for the particular period, if additions to reserves and collective contributions are ignored.

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[1] It may be useful to quote here the opinion of Mr. C. W. Fulker, a prominent official in the co-operative movement: "It is time more thought was given to the maximum size of retail societies, because of the virtual impossibility of maintaining utmost efficiency once the number of shops gets into the hundreds. The economies associated with standardisation soon begin to be lost when organisations become very large." ("Size versus Efficiency", *The Co-operative Review*, May 1948.)

3

As a *first approximation* it is assumed that members of a co-operative society look upon the periodic dividend simply as a deferred rebate, or price reduction, on their purchases. The significant price on this assumption is the 'net price' charged by the society. In the circumstances postulated the members and potential members of the society, when deciding whether or not to patronise it, deflate the 'gross price' by the amount they consider will be returned to them at the end of the trading period.

The decision whether or not to support the society depends to some extent at least upon a comparison of the society's 'net price' with prices charged by competing retailers in private trade. Of course, a 'net price' higher than that charged for similar services by competitors need not mean that the society loses all its support. As long as some members are prepared to give practical expression to their belief in the co-operative movement's principles some business will be retained. On the other hand, a 'net price' below that charged by competitors cannot draw all business to the society; the antipathy of some consumers towards co-operative enterprise is sufficient to make it impossible for a society to capture the market. In short, the services supplied by a co-operative society are differentiated from those of its competitors, and it is reasonable to assume that the demand for its services is not perfectly elastic. The degree of elasticity depends upon the loyalty of individual members and upon the strength of their preference for the co-operative method of trading. Undoubtedly different societies are not equally fortunately placed in these respects.

It is of interest to note, in passing, that one of the bases of the 'product differentiation' in retailing achieved by co-operative societies differs significantly from the more common bases of differentiation that some observers[1] consider important in the retail market. For example, the advantages arising out of a desirable location, or the provision of novel and desired services, which may be secured initially by an enterprising retailer, may soon be countered and removed by his competitors who are free and eager to follow the reasons for his success. But it is not possible for private retailers to simulate that feature of co-operative retailing which partially explains the success of the co-operative movement, namely, the loyalty of some co-operators to the principles of co-operation. Unlike the private trader who derives merely temporary security from successful product differentiation, the co-operative society finds permanent shelter in the goodwill engendered by the peculiar nature of the enterprise.

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[1] E.g., H. Smith: *Retail Distribution*, Second Edition (1948), *passim*.

4

It is the " avowed object " of many co-operative societies to " sell at market prices ".[1] A policy of selling at market prices presumably means that the society's management charges a price which is believed to be current in the market it has decided to serve. It means that the management is prepared to be passive in the determination of the price at which it sells. In this Section the implications of a passive price policy are traced.[2]

In Figure 1 AC represents the long-run average cost curve of a retail society. Suppose that the price that is being

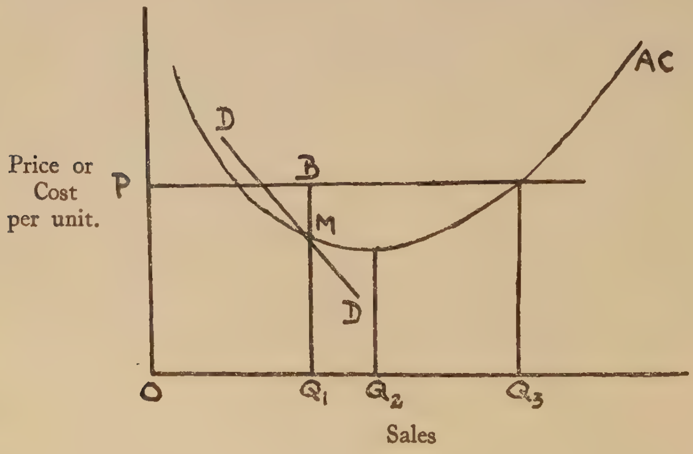

FIGURE 1.

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[1] H. Smith: *op. cit.*, p. 55; A. M. Carr-Saunders *et al.*: *Consumers' Co-operation in Great Britain*, Revised Edition (1942), p. 117.

[2] " Following the market price " as a policy is discussed in greater detail in Section 10 below.

followed (i.e., the ‘ market price ’) is OP, so that over some range of output total sales proceeds are greater than total expenses. (This postulated relationship between market price and costs of operation may be due to the management’s interpretation of what the market price is, or it may be due to economies that the society is able to secure. The reason does not concern us here.) Let the society’s sales at price OP be OQ_1 ; i.e., the demand curve DD, indicating the volume of sales at different ‘ net prices ’, cuts the average cost curve at the point M. The dividend per unit of sales is BM, the rate of dividend is $\frac{BM}{BQ_1}$, and the ‘ net price ’ is MQ_1.[1]

It is apparent that a passive price policy alone cannot ensure that the society is operating at the level of output at which average costs, and therefore the ‘ net price ’ to members, are at their minimum.

In the course of time sales at price OP may increase, i.e., the demand curve DD may shift to the right.[2] There may, for example, be a secular growth in the society’s membership, or members may have command over larger incomes. Whatever the cause of the growth of business, the increase in sales is accompanied by a fall in ‘ net price ’ until the sales volume reaches OQ_2, where average costs are at their minimum. The fall in ‘ net price ’ in turn stimulates sales. All members are better off as a result of the success of their society.

It would be mere coincidence if the secular growth of a society were to cease at a point where sales were OQ_2 and average costs at their minimum. Growth may proceed beyond this point. If this should happen the rate of dividend falls and the ‘ net price ’ rises. The latter consequence inhibits further growth somewhat, but not completely; new business may still be attracted. The theoretical limit to growth would be attained when sales were expanded to OQ_3, at which level there would be no dividend and the ‘ net price ’ would be equal to the market price OP, which it is the society’s policy to follow.

Growth beyond the ‘ technical optimum ’ would be against the interests of existing members of the society if their interests are solely to lower the costs of supplying themselves with some of their requirements. If the principle is adopted, as is in fact the case, that membership of the society is open to all without any entrance payment being demanded of new members, the size of the society seems to be beyond the members' or management's control,[1] and growth would eventually involve higher average costs of operation. Missionary zeal to swell the membership, the availability of funds to finance expansion, and the salaried managers' interests in expansion may hasten the movement towards higher costs.

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[1] Additions to reserves and collective contributions are ignored.

[2] The discussion is drastically simplified by assuming that cost conditions and the market price remain unchanged.

It may be argued that when a society's sales had reached OQ_2 the time would be appropriate for forming a new society to take care of the needs of new co-operators in the particular town or district. In fact this development is not likely to happen. The co-operative movement is not likely to countenance competition between societies serving the same locality. It has steadfastly expressed its disapproval of 'overlapping' by competing societies, and the central authority has used its influence to hasten the amalgamation of competing societies or to regulate competition by defining the trading boundaries of competing societies.[2]

5

Even with a passive price policy the management of a society is not entirely unable to influence the volume of the society's sales. Expenditure on sales promotion may be increased or reduced to secure a closer approximation, if that is desired,[3] to the volume of sales at which average costs are at a minimum. It is possible that a new society may not have the resources to finance intensive drives for membership or sales; and the success of sales promotion outlays at this stage is by no means assured. On the other hand a society may find it difficult or hazardous to curtail promotional activities when it has reached the desired level of sales.

The management may also vary the quality of the society's services, and so influence both the demand for its services and its costs of operation. However, it is likely to be difficult to judge in advance the net effect of such changes on the volume of sales. It is doubtful, too, whether existing members are likely to permit serious alterations in the quality of service.

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[1] But see Section 5 below.

[2] *See* S. and B. Webb: *The Consumers' Co-operative Movement* (1921), pp. 70 *et seq.*; Carr-Saunders, *op. cit.*, p. 80; J. A. Hough: *Dividend on Co-operative Purchases* (1936), p. 135: "Competition between co-operative societies is bad, and is the antithesis of the principle for which the societies themselves stand".

[3] And it need not be desired. *See* Section 11 below, where several possible objectives of price policy are considered.

6

Maintaining our first approximation that members regard the dividend simply as a deferred rebate, nothing material is altered if a society switches from a passive price policy (of following the market price) to an active price policy of setting its 'gross price' at any level it considers suitable. At any time the society's sales volume is determined by the positions of the demand curve (DD in Figure 1) and its average cost curve. The 'gross price' is irrelevant, since it has been assumed as a first approximation that members deflate the 'gross price' to the 'net price' by subtracting the dividend that they expect will be returned to them. A higher or lower 'gross price' means a higher or lower dividend, but an unchanged 'net price' (if members' expectations are consistent). Control over the 'gross price' gives the management no additional control over the sales volume.

There is one case where the situation is materially altered. That is where purchases made by non-members, who do not qualify for dividends on their purchases, are significant in amount.[1] Here a reduction in the 'gross price' may secure an expansion of sales, and vice versa.

Assuming that it is the society's objective to serve its members at lowest possible cost, the management's decision about price depends upon whether or not the surplus earned on sales to non-members swells the fund out of which dividends are paid to members. If the surplus on non-members' purchases is paid to members, the society's policy should be to select the 'gross price' at which the marginal revenue from sales to non-members is equal to the marginal cost of the enterprise. If, on the other hand, the surplus is not paid to members but is segregated in a separate fund that does not become available to members,[2] the policy should be to select the ‘ gross price ’ at which members ’ and non-members’ purchases together approximate the desired level as closely as is possible. In either case it does not follow that the society can at all times attain the optimum ; but undoubtedly the management’s power to approach the objective as nearly as possible is considerably increased if non-members’ purchases are at all large.

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[1] Sales to non-members are unimportant in English and Scottish societies. *See* J. A. Hough: *op. cit.*, p. 137.

[2] This is the case in Swedish societies. *See* A. P. Aizsilnieks: "The Price Policies of Consumer Societies and Price Determination Theory", in *Ekonomisk Tidskrift*, September 1947. If the special fund indirectly, immediately or in the future, becomes available to members, the results for policy are not formally distinguishable from those indicated in the preceding sentence in the text.

7

In the real world, or at least in Great Britain, many members of co-operative retail societies do not behave as if the periodic dividend on purchases is merely a postponed price reduction, accumulated by the society and periodically refunded to members. The amount or rate of dividend may itself influence sales. To some members a price of ninepence without dividend may be less attractive than a price of tenpence with a refund (accumulated with refunds on other purchases) of one penny, repaid at half-yearly or quarterly intervals. To some members it may be less attractive even than a price of elevenpence with a refund of three-halfpence.

Our first approximation is certainly not valid in co-operative retailing. Nevertheless the analysis in the preceding Sections is not without some relevance. It serves to illustrate some of the possible consequences of the practice of open membership. Also, it may fit the case of retail societies where the rate of dividend is low, and is for that reason not likely to influence the attitude of members.[1] And it may fit the general case of co-operative societies where the consumer of the service is likely to adopt a ‘ realistic ’ attitude towards the dividend, such as has been assumed as our first approximation, e.g., in agricultural marketing associations and in co-operative wholesale societies ; or of co-operative enterprise in which dividends on purchases (or sales) play no part, as in co-operative research associations and co-operative advertising groups. The bias against competition between societies, the practice of open membership, and loyalty to the idea of co-operation may give rise to the developments set out in earlier Sections.

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[1] This may be true in Sweden, where dividend rates are lower than in Britain. Professor Aizsilnieks (article quoted in previous footnote) has analysed the price problems of Swedish co-operative retail societies with the implicit assumption that it is the ‘net price’ alone that is relevant. His analysis covers the main types of market situations dealt with in the theory of imperfect competition.

8

To the extent that our first approximation is wide of the mark the rate of dividend on purchases becomes an important and partly controllable factor influencing the number of a society's members and their purchases. From the society's point of view the dividend may have powerful promotional effects.[1] A cut in the 'gross price' or even in the 'net price' may in fact in some cases lead to a reduction in the volume of sales, if the dividend rate is reduced as a consequence.

The significance of the rate of dividend is well recognised by those concerned with co-operative retailing. A recent example may not be out of place here. In 1948 the National Co-operative Authority in response to the Chancellor of the Exchequer's plea for price reductions recommended that retail societies should lower the ('gross') prices of basic foodstuffs. These price cuts would have had no effects on sales if our first approximation were appropriate. But many societies, after a period of trial, decided that the policy was not desirable, because they feared that the resultant cut in dividend rates would be injurious to the societies.

The net result of any reduction in the 'gross price' depends upon the reactions of members. Some members preferring immediate benefits to deferred ones may increase their purchases; other members, swayed largely by considerations of the rate of dividend, may increase or decrease their purchases depending upon whether the rate of dividend is increased or not; whilst others, whose behaviour corresponds to our first approximation, would react according to whether the 'net price' is raised or lowered. The full effects of price changes may appear only after the period's trading has been completed. Moreover, the practice of equalising rates of dividend by using reserves may for some time obscure the effects of price changes.

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[1] From the society's point of view the dividend, and members' reactions to it, may mask comparisons between the efficiency of a society and its private trade competitors. To quote a commentator: "Rid the movement of this 'divi' complex and we may be able to assess our trading efficiency in relation to that of our competitors" (*The Co-operative News*, 28 February, 1948).

It is likely that the net effect of a given price change varies from society to society, and in different circumstances in the same society. It is quite possible that in the main a change in the rate of dividend is likely to have more significance for most members than an equivalent change in the 'gross price' (and *a fortiori* in the 'net price'). The former change is strikingly obvious to members; the latter is a change reflected in numerous small changes in the prices of many different articles of merchandise. Here it is enough to observe that the price charged by the society at the time of sale, and the rate of dividend, are factors that the management has to take into account in framing its price policy. Management's task is considerably more complicated here than in the case of a co-operative society for which our first approximation holds good, or of a private firm not distributing dividends on purchases. However, it is possible that the management is more adequately armed to pursue whatever objective it may consider to be desirable. Some of the implications of the more realistic assumptions about the behaviour of co-operators are traced in the following Sections.

Before proceeding it should be noted that the payment of dividends on purchases is not a feature distinguishing co-operative from private trade. Some private traders, though they are a small minority, distribute dividends to their customers; others achieve the same end by issuing redeemable trading stamps or tokens to their customers. The Committee on Gift Coupons and Trading Stamps considered it an argument in favour of the practice of issuing trading stamps that "they enable retailers to compete more successfully with co-operative societies".[1] The prewar Milk Marketing Schemes, in terms of which minimum retail prices were fixed, made provision that "other distributors may pay dividends comparable with those paid by the consumers' co-operative societies".[2]

9

The consequences of a passive price policy of "following the market" may be briefly traced. In Figure 1 assume that the price followed is OP, at which at first sales are OQ_1 and the dividend BM. Secular growth of the society gradually raises the dividend rate and lowers the ‘ net price ’ until sales reach OQ_2. Growth sets in motion forces that further stimulate the expansion of sales. On the other hand growth beyond OQ_2 is retarded, since it involves lower dividend rates as well as higher ‘ net prices ’. The conclusions of Section 4 are not altered, save that changes in the rate of dividend accelerate expansion until the point of minimum average costs is reached and restrain expansion after that point has been reached.

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[1] Report, Cmd. 4385 of 1933, para. 45.

[2] Milk: Report of Reorganisation Commission, Ministry of Agriculture and Fisheries, Economic Series No. 44 (1938), p. 87.

10

A passive policy of “ following the market ” may be adopted by small or new societies where the fear may be strong that direct price-cutting (but not the indirect price-cutting achieved by the payment of dividends) would invite price retaliation by their private competitors. But it can never be followed completely even by small or new societies ; and it is doubtful whether larger or well-established societies would consciously follow such a policy. There is no one ‘ market price ’ for many items of merchandise at retail ; prices of the same merchandise are not uniform at all selling points, unless there are privately or publicly imposed minimum prices. A society that “ follows the market ” is not passive. It has to select that sector of the market that it wishes to follow, and the choice itself implies an active policy. For example, the management may have to decide whether or not to meet the price cuts introduced by one particularly aggressive competitor. Further, retail societies handle many lines carrying the co-operative label, which are not stocked by private retailers. In the pricing of such merchandise there can be no directly comparable price to follow. Also, in many cases it is quite clear that many private retailers in fact follow the prices of a large co-operative society in the area.[1]

11

If the management adopts an active price policy it has to make allowance for the effects on the volume of business of the change in ‘ gross price ’ it proposes, the resultant change in the rate of dividend, and in the ‘ net price ’. The difficulties of forecasting the likely effects of price changes are immense, and it is understandable why in practice managements of societies will not often be willing to experiment with changes in prices or rates of dividends, more so as 'price-cutting' may provoke retaliation.

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[1] *See* H. Smith : *op. cit.*, p. 55.

Abstracting from the possibility of retaliation, which complicates the issue without changing its nature, it may be asked what objective the management 'ought' to pursue in the interests of the society, when framing its price policy. The management of a capitalist enterprise may normally be expected to aim at maximising the profits accruing to its owner (subject to the owner's directions, if any, to the contrary). Is there a similar clear-cut maximisation criterion which should guide the co-operative society's management, and by which the success of its efforts may be judged? Several alternatives may be considered, and the following enumeration is not to be regarded as exhaustive. Moreover, it should be noted that a society's objective, or one of its objectives, may be such that its attainment would not be reflected in the society's trading results. Some co-operators, for example, believe that societies should follow a low price policy, because this might force other retailers to reduce their prices, and so benefit *all* consumers.

(1) The management may attempt to maximise the dividend to members. This may be interpreted either as maximising the sum of money that the average member receives at the dividend date, or as maximising the rate of dividend, i.e., the dividend expressed as a percentage of the members' purchases.

The objective of maximising the dividend to members is likely to mean a high 'gross price' policy, and to involve resistance to growth. It is likely to be favoured by those members who regard co-operative trading as desirable principally because it may serve to make the accumulation of small savings easy and convenient, and by all other 'dividend-hunters'. The rate of dividend may come to be regarded as an index of the society's success, so that its maximisation may become a goal. Many societies have found that high duties, such as the purchase tax and the duty on tobacco, cause difficulties, because they tend to lower the rate of dividend (as long as controlled profit margins are not calculated as a flat percentage on cost including tax).

(2) The management may attempt to maximise the aggregate surplus out of which dividends are paid to members. The objective of maximising the dividend fund at the disposal of the society may serve a society (or its management) that wishes to accumulate funds for expansion or security as rapidly as possible. The maximisation of the aggregate surplus probably makes it easiest for the society to retain the maximum amount of surplus as additions to its reserves; in addition, or alternatively, it maximises the sum available for dividend payments to members, some portion of which is generally left in the society as loans. It is conceivable, too, that members may judge the success of their society and the ability of its management by the size of the disposable surplus. It is this figure which, superficially, resembles a company's "Profits on trading, available for distribution".

(3) The management may attempt to maximise the volume of business transacted by the society. This may be interpreted either as maximising the value of the sales turnover of the society, or as maximising the physical turnover of the society (as measured, for example, by the number of its employees).

The objective of maximising the volume of trade is one that may appeal to the management. Their personal prestige in the movement and possibly the remuneration of some members of the management may depend upon the size of the organisation they manage.[1] Moreover, both the members and the management in their zeal for the cause of co-operation in general, and for the 'success' of their society in particular, may set considerable store by the mere volume of business they handle.

(4) The management may attempt to sell as cheaply as possible, that is, to reduce 'gross price' as far as possible. This objective is a likely one where a large proportion of members regard the dividend as an agreeable consequence of co-operative trading, but not something that is taken into account when deciding whether or not to patronise the co-operative society rather than its competitors; or, more likely, where the majority of members have no adequate margin for savings.

(5) The management may attempt to minimise the average cost of operation (i.e., the 'net price'). The objective will

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[1] A similar possibility is present, of course, in the case of privately owned enterprises.

appeal to many members, at least to some extent. The strength of the drive to reach this objective must depend largely upon the relative proportion of members whose behaviour comes close to our first approximation, and to the absence of any strong preference on the part of management or members to see their society grow at all costs.

In practice the nature of the demand may be such that in certain circumstances the achievement of two or more of the listed objectives may require the same 'gross price' to be set.

12

It may be argued that since members control the activities of their society the society will select the objective that the majority of the members prefer. The management would merely attempt to comply with the expressed wishes of the majority of members. However, in many societies democratic control by members does not extend as far as the framing of price policy. The management, or the departmental managers, may frame policy as well as execute it. The management's task is to hit upon that compromise most acceptable to members. The interests of some members of the management may well differ from those of many of the members. And the policy or compromise adopted cannot be equally acceptable to all members. Some may prefer a price policy aiming at maximum rates of dividend; others may prefer a low price policy. The possibility of conflict is well illustrated in the following judgment of the Webbs: "In so far as there is a tendency in Great Britain to charge high prices deliberately in order to produce high dividends, instead of adopting the policy of low dividends and low prices as in Germany, there is legitimate ground for criticism. The policy, either consciously or unconsciously, tends to exclude the poorest class, and thus prevents that national expansion to which the Rochdale pioneers looked. Though it may suit the purses and convenience of the present members, by facilitating thrift and making their savings available in a form which the housewife finds profitable, yet this system tends to contract the area of further membership."[1]

Another illustration of possible conflict is furnished by the 1948 price cuts experiment. Here the price cuts were confined to a limited number of basic foods. It was pointed out that the selective price cuts favoured the members who purchased only their food requirements from the society, at the expense of members who patronised all the merchandise departments of the society. Similarly, payment of full dividends on tobacco purchases (or in any department that fails to yield the rate of surplus earned by the society as a whole) favours the purchaser of tobacco at the expense of other members. Some societies make use of the device of departmental dividends, or exclude certain purchases in the calculation of members' dividends, to take account of the more obvious departmental differences.

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[1] S. and B. Webb: *op. cit.*, p. 297.

The practice of open membership complicates the issue, as the management is not constantly serving the same group of members. In some cases a change in the principal policy objective may bring about a gradual change in the composition of the society's membership. To sum up, the management of a capitalist enterprise knows what it should try to maximise and for whom: the management of a co-operative society has a choice of what it should try to maximise (or minimise) and for whom.

In practice different societies are likely to follow different policies, or rather different combinations of several possible objectives; and, as indicated in the next Section, once a society has adopted a certain policy it may find it difficult to depart from it later. It is not possible to say which objective, on balance, looms largest in the minds of co-operative policy-makers. It is, however, interesting that some co-operative officials claim that in dealing with price problems they act as they would act if they were running their own business. This suggests that within the limits imposed by a society's past dividend history the management attempts to maximise the society's trading surplus.[1]

It would be most useful from the management's point of view if it were free to follow a price policy that would simultaneously satisfy members with conflicting ideas and preferences about prices and dividends. For example, it would be useful if a society could offer the same service on different price and dividend terms to different members, at the latter's option. The suggestion has been made that differential pricing may be practised to attract the custom of less regular patrons of co-operative societies,[1] or of others who are not interested in co-operative dividends. Alternatively, a society may attract different types of customers by varying the quality of service, ' gross price ', and dividend rates from branch to branch. The Webbs suggested that societies could cater specifically for the poorest consumer by opening new branches selling " as near to cost price as can safely be managed, cutting off such luxuries as free delivery . . . . . . and never aiming at a dividend of more than sixpence in the pound ".[2] Mr. Hough's recent suggestion that the rate of dividend on purchases may be more important in connection with some purchases (e.g., of staple foodstuffs) than with others (e.g., of fashion goods) indicates that different price and dividend policies in different merchandise departments may be useful.[3] The difficulties of implementing any of these suggestions may be formidable; and no society, as far as I know, has given effect to any of them.

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[1] This is apparently true in the U.S.A. where "consumer co-operatives often duplicate the policies of regular businesses". *See* S. Enke: "Consumer Co-operatives and Economic Efficiency", *American Economic Review*, March 1945, p. 149.

It may be noted that price policies need not result in operations at lowest (attainable) average costs. Competition from private firms may prevent serious deviations from the technical optimum; though resistance against competition will naturally be strongest where habits of co-operative trading and loyalty to the co-operative movement are most firmly entrenched. This conclusion may be a corrective to the view that the growth of co-operative trading must necessarily reduce the ' waste ' in distribution caused by the (alleged) conditions of monopolistic competition in present-day retailing.

13

" Most societies tend to set themselves a rate of dividend, to maintain it year by year, and to subordinate their price policy to obtaining it."[4] In the majority of cases the reason for adopting a policy of maintaining the rate of dividend is clear: once a certain rate has become established, any departure from it is expected to set in motion a series of repercussions considered by the management to be unfavourable or undesirable. A reduction in the rate of dividend may disappoint the established expectations of many members. Their loyalty may be weakened, and the entry of new members may be discouraged by what may be considered the failure of the society. An increase in the rate of dividend, unless the management is confident that the increased rate could be maintained in the future, may arouse expectations in the minds of members which, when disappointed, are likely to have similar unfavourable reactions. During the war some societies made use of the expedient of declaring bonus dividends in addition to the ordinary dividend at the usual rate. "The method adopted of disbursing additional amounts of net surplus as a bonus dividend over and above the normal dividend was so that it would be understood that the feature could not be expected to remain in a permanent sense. It is much easier for a Co-operative Society to declare a bonus for one period and not for the next, than to raise the usual rate of dividend in one good period and have to lower it again in the next period."[1]

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[1] See *The Co-operative News*, 29 May, 1948.

[2] S. and B. Webb: *op. cit.*, p. 316.

[3] J. A. Hough: *Co-operative Retailing, 1914–1945* (1949), p. 135.

[4] H. Smith: *op. cit.*, p. 57.

If members of consumer co-operatives behave like this we are a long way from our first approximation of consumer behaviour, introduced for purposes of exposition in Section 3 (above). The management of a society, having initially selected a policy (for example, one of the alternatives set out in Section 11 above, or a mixture of them) giving rise to a particular rate of dividend, or having had a rate of dividend determined for it by the pressure of external conditions, is thereafter to a considerable degree at the mercy of that rate. The maintenance of that rate, or if that is not possible, the maximisation of the dividend rate, may subsequently become the objective of price policy.

It is the inhibitory influence of the past dividend record of a society that may partially restrain a society from extending its range of merchandise or activities; for the opening of new departments may be inadvisable unless it may be safely expected that the new department will be able to earn the customary rate of surplus. For the same reason societies may invest their accumulated funds outside the society.[2] Investment of this kind increases the surplus without increasing the base (i.e., sales) upon which the rate of dividends is calculated and declared; whilst investment in new departments may possibly increase the base proportionally more than it increases the surplus.

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[1] J. A. Hough: *Co-operative Retailing, 1914–1945*, p. 94. There is a similar tendency for managements of some public companies to stabilise rates of dividend.

[2] See the remarks of Mr. Daines, *The Co-operative News*, 5 February, 1949.

The maintenance of a particular rate of dividend may be impossible in practice. In Great Britain the average rate of surplus earned has fallen steadily.[1] The fact that dividend rates in many societies have been altered, not deliberately but under the stress of circumstances, without consequences crippling to the societies suggests that some managements are unnecessarily apprehensive of taking measures that may endanger the dividend rate.

14

Differences of opinion amongst co-operators about price policy may spring from differences in the objectives they favour, or from differences in the dividend histories of particular societies, or from differences in views about the probable effects of given changes in prices. At present there appear to be two main trends of thought amongst co-operators. One school considers that dividend should be left to " find its own level ",[2] and that the dividend " should be an effect and not a cause ".[3] In general this school believes that societies should broaden their range of merchandise and retailing activities, and should enlarge their membership by attracting, if possible, more middle class consumers. The other school believes that the policy of attempting to maintain established rates of dividends is appropriate. Given these differences of opinion and objective, it is not likely that the co-operative movement will achieve uniformity of policy with respect to prices and dividends, unless the sharpening of the competition of private traders and the equalisation of competitive pressure in all areas bring this about without the conscious decision of the movement as a whole.

Appendix

Professor Stephen Enke[4] has suggested that there is an ideal price policy that co-operative societies should follow in the interests of their members as well as in the interests of improved 'resource allocation' for the economy as a whole. He claims that the co-operative society is "at least one type of business organisation which under certain circumstances can be theoretically expected to achieve economic efficiency [improved resource allocation] while simultaneously serving important private interests [the interests of its members]".[1] He states that co-operative societies at present do not follow the 'ideal' policy; but that if they did so do they "should perhaps receive greater public support through legislation".[2]

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[1] *See* J. A. Hough: *Co-operative Retailing, 1914–1945*, p. 95.

[2] R. Southern: *The Co-operative News*, 24 April, 1948.

[3] J. A. Hough: *Co-operative Retailing, 1914–1945*, p. 92.

[4] S. Enke: "Consumer Co-operatives and Economic Efficiency", *American Economic Review*, March 1945.

In elaborating his ideal price policy Professor Enke employs as his criterion of the interests of members the maximisation of their consumers' surplus, the dividend on trading being counted as an addition to the consumers' surplus. As the welfare criterion for the economy at large he accepts the Hotelling 'rule' that "all business units follow a price policy which results in a scale of operations such that marginal cost is equal to the marginal demand price of the market".[3]

Utilising a 'demand curve' (showing sales at different 'gross prices') "drawn on the assumption that buyers have no anticipations regarding eventual rebates",[4] he demonstrates that both requirements are satisfied if the society charges a 'gross price' equal to the marginal cost of the corresponding level of sales.

Without examining the criteria, or the difficulties of implementing the indicated policy, it may be questioned whether a policy of equating 'gross price' and marginal cost is necessarily in the members' interests. One may ask whose consumers' surplus is to be maximised, since the same members are not likely to be equally attracted by different price and dividend policies. (See Section 11 above.) One may also question whether it is realistic to assume that all members "have no anticipations regarding eventual rebates", particularly in societies where the rates of dividends are high. In so far as anticipated dividends are taken into account by some members as an offset against the 'gross price' paid in the first instance, it is not useful to treat the 'gross price' paid as a measure of the intensity of consumer demand or preference. Moreover, if as has been suggested above, some members regard the dividend as something more than a mere repayment of part of the original price paid, the relationship between the amount of dividends received by a member and the ‘ utility ’ derived from it by the member is by no means one of necessary equality.

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[1] S. Enke, *loc. cit.*

[2] *Ibid.*, p. 148.

[3] *Ibid.*, p. 148.

[4] *Ibid.*, p. 148. 'Rebates' is the same as 'dividends'.

Perhaps the only valid ‘ welfare ’ proposition (and that one which is not at all useful as a guide to action) is that the price policy adopted by any society is the one that maximises its members’ satisfaction, since they voluntarily select it, or better, since they voluntarily conform to it.

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The Decline of Ricardian Economics in England

By Ronald L. Meek

Much damage has been done to the study of the history of economic thought in this country by the general adoption of what may be called a *teleological* approach to the work of the Classical economists. Modern historians too often tend to be interested not so much in investigating the particular problems which their predecessors believed to be important and the reasons which motivated them in their choice of weapons to attack these problems, as in tracing the genealogies of modern theories and supplying them with respectable pedigrees. We seem to find it extraordinarily difficult to escape for a moment from contemporary prepossessions and problems and to imagine an age in which a number of the basic questions at issue, and even the " economic problem " itself, were different from those of our own time. We sometimes tend to suggest, for example, that the absence from the Classical system of some particular doctrine which we to-day regard as vitally important must necessarily have hindered that system from performing the tasks which it set out to perform ; and even more often we imply that if such a doctrine does appear in the Classical system it must necessarily have assumed the same degree of importance in that context as it does in its present one. We visualise economic theory, in other words, as evolving almost *purposively* towards its present state. This article, which criticises certain modern accounts of the development of " Ricardian " doctrines in England, is intended primarily as a criticism of the teleological approach which lies behind these accounts.

Most historians of economic thought have laid considerable stress on the theoretical innovations of the 1870s as marking the real dividing line between Classical political economy and modern economics, and have tended to treat the pioneer work of the amazing decade following Ricardo's death as little more than a flash in the pan. Even Professor Seligman seems to have believed that this work had very little influence upon the intellectual climate of the time[1]; and Miss Bowley, who has recently called so emphatically for a revision of the traditional interpretation of the period, still appears to maintain that an "orthodox Ricardian" school flourished in England from the death of Ricardo to the time of J. S. Mill's recantation of the wages-fund doctrine—even if another more heterodox line of economists was at the same time engaged in research in different directions.[2] Even when it is not suggested that "Ricardianism" was successful in conquering the whole of the territory, it is usually implied that its victory was complete in those areas where it did conquer. It is agreed that certain "modern" concepts were formulated by a few economists before the 1870s, but it is generally denied that they exercised any significant influence on the pure "Ricardian" strain until the time of the Mengerian revolution.

Since the publication of the *General Theory*, with its suggestive redefinition of "Classical" economics, a new basis for the interpretation of the post-Ricardian period has been discovered. Early in the *General Theory*, it will be remembered, Keynes comments upon the disappearance of the "great puzzle of Effective Demand" from economic literature after Ricardo's time. "The completeness of the Ricardian victory", Keynes writes, "is something of a curiosity and a mystery". The well-known remarks which follow this statement were presumably intended to refer specifically to Say's Law rather than to the Ricardian system as a whole, but there is no doubt that Keynes regarded Say's Law as "fundamental to the Ricardian economics", as the very essence and basis of the Ricardian system.[3] From Keynes's point of view, the great divide between Classical and contemporary economics occurred not in the 1870s, but in 1936.

This identification of Ricardian economics with Say's Law was a useful and striking pedagogical device. It was designed to emphasise the most significant feature of Keynes's own contribution, and it succeeded admirably in its purpose. But to use it, as Mr. Checkland has recently done,[4] as the basis for a re-interpretation of the early post-Ricardian period, is surely an example of the teleological approach at its most extreme. Mr. Checkland assumes without question that Say's Law was in fact "the basic premise of the New School" and proceeds to discuss the propagation and ultimate victory of the doctrines of the school in terms of the tactical and strategic advantages enjoyed by those who believed in the truth of Say's Law. If Mr. Checkland had been concerned only to account for the early victory of Say's Law over Malthus's underconsumptionist doctrine there might have been much less to complain of in his article, but it is fairly clear from his language that he is in fact trying to account for the victory of the "Ricardian" system as a whole.

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[1] "On Some Neglected British Economists", *Economic Journal*, 1903, pp. 534–535.

[2] *Nassau Senior and Classical Economics, 1937*, passim.

[3] *General Theory*, pp. 32–33 and footnote to p. 3.

[4] "The Propagation of Ricardian Economics in England", *Economica*, February 1949.

Was Say's Law actually the basic premise of the Ricardian school? There is, of course, no doubt that the new school regarded Say's Law as extremely important. Ricardo selected Say's chapter "Des Dêbouchés" for special commendatory mention in a footnote to the preface of his *Principles*,[1] and McCulloch described the doctrine of the dependence of effective demand upon production as Say's "principal merit in a scientific point of view".[2] But to show—what indeed is obvious—that Ricardo and his disciples regarded Say's Law as a very important principle is not to show that it was the "basic premise" of the school or to justify the identification of which I am complaining. The first part of what follows is designed to throw doubt on the assumption that we can say anything really useful about the development of Ricardo's system as a whole after 1823 merely by accounting for the survival of this one particular doctrine. The second part outlines a different approach to the problem.

I

Ricardo's attention had been drawn to the significance of what he then called "Mr. Mill's principle" at least as early as 1814 when, in the formative period of his mature thought, he was arguing with Malthus over the effect upon profits of restrictions on the import of corn. Malthus appears to have affirmed early in the debate, as against the "commercial"[3] viewpoint which Ricardo was defending, that restrictions on import would not lower the rate of profit "if the consequence of such restriction be a great reduction of capital".[1] Ricardo, arguing from different political premises and not easily overawed by the authority of Adam Smith, replied that the effect upon the rate of profit of restrictions on import must be considered independently of the effect of a reduction of capital, since "there is no necessary connection between these two operating causes, as they may at the same time be acting together or entirely in opposite directions".[2] So far as the second cause was concerned, Ricardo agreed with Malthus that "when capital is scanty compared with the means of employing it, from whatever cause arising, profits will be high",[3] but the two men were not agreed on the *reason* for this inverse relationship between capital accumulation and the rate of profit. It was out of their controversy around this problem that the new Ricardian system eventually emerged.

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[1] *Works* (McCulloch's edition), p. 6.

[2] *The Literature of Political Economy*, p. 21.

[3] Cannan: *Theories of Production and Distribution*, p. 164.

Malthus suggested that if restrictions on import brought about a considerable diminution of capital, the effect of this diminution upon profits would probably be sufficient to neutralise the opposite effect of any rise in wages which might result from the restrictions. The "proportion of demand to supply" might continue to increase, so that profits would not necessarily fall. Ricardo admitted that "capital and produce may diminish faster than demand" in the short period, but contended that in the long run "effective demand cannot augment or continue stationary with a diminishing capital".[4] Some time early in September, 1814, Malthus appears to have shifted the argument on to a more general plane, probably relating the issue directly to the version of Say's Law put forward by James Mill in his *Commerce Defended*. On September 16th Ricardo wrote as follows: "If you think that, with an increase of capital, men will become indifferent both to consumption and accumulation, then you are correct in opposing Mr. Mill's idea, that in reference to a nation supply can never exceed demand". But, Ricardo argued, there was actually no reason why effective demand should not increase *pari passu* with capital, since the wants and tastes of mankind were unlimited. "We all wish to add to our enjoyments or to our power. Consumption adds to our enjoyments, accumulation to our power, and they equally promote demand."[1] Malthus, however, continued to contend that accumulation might influence profits more directly than Ricardo supposed—by increasing the supply of commodities to such an extent that the effective demand was insufficient to absorb the whole supply.

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[1] *Letters of Ricardo to Malthus*, pp. 35–36 (letter of 25.7.14).

[2] *Ibid.*, p. 36.

[3] *Ibid.*, p. 43 (letter of 16.9.14).

[4] *Ibid.*, p. 39 (letter of 11.8.14).

Ricardo recognised that the problem was a crucial one. "It is very important", he wrote, "to ascertain what the causes are which make capital scanty compared with the means of employing it. . . . It is in this inquiry that I am led to believe that the state of the cultivation of the land is almost the only great permanent cause."[2] The state of the cultivation of the land, he argued, is "almost the sole cause which regulates the profit of stock and the means of advantageously employing capital".[3] And by December, 1814, the place of accumulation in the new Ricardian system had been made quite clear:

> "Accumulation of capital has a tendency to lower profits. Why? because every accumulation is attended with increased difficulty in obtaining food, unless it is accompanied with improvements in agriculture; in which case it has no tendency to diminish profits. If there were no increased difficulty, profits would never fall, because there are no other limits to the profitable production of manufactures but the rise of wages. If with every accumulation of capital we could tack a piece of fresh fertile land to our Island, profits would never fall."[4]

Here the skeleton of the system of the *Principles* is clearly displayed. Flesh and spirit are still wanting, but by the time of the publication of Ricardo's essay on the profits of stock both had been supplied. The flesh consisted of the new theory of rent, towards which Ricardo himself had obviously been groping during the later months of 1814. The spirit—the central principle of the whole system—was the labour theory of value, to which Ricardo was coming to attach ever-increasing importance.

It appears from this correspondence that the main role of "Mr. Mill's principle" in the early formulations of

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[1] *Ibid.*, pp. 43–45. Cf. p. 49.

[2] *Ibid.*, p. 43.

[3] *Ibid.*, p. 46 (letter of 23.10.14).

[4] *Ibid.*, p. 53 (letter of 18.12.14).

Ricardo's system was to confirm the theory that "the increased difficulty of obtaining food" was the *only* permanent cause of a fall in profits. Accumulation certainly influenced profits—but only per medium of a rise in wages. Malthus, on the other hand, was concerned to prove that accumulation might also react upon profits directly per medium of a failure of effective demand. Ricardo defended Say's Law primarily because it provided corroborative evidence in favour of his own view. In his essay on the profits of stock he felt sufficiently sure of himself to put forward his own doctrine quite dogmatically, without specifically adducing Say's Law in his defence or noticing Malthus's objections. And even in the *Principles*, where Ricardo discusses Say's Law at some length in relation to Smith's theory of profit, its subordinate place in the basic theoretical structure is made fairly clear. "From the account which has been given of the profits of stock", Ricardo writes at the beginning of the chapter entitled "Effects of Accumulation on Profits and Interest", "it will appear that no accumulation of capital will permanently lower profits, unless there be some permanent cause for the rise of wages". Ricardo clearly believed that Smith and Malthus had already been refuted by the theory of profit outlined in the preceding chapters, where Say's Law had not been mentioned. But Say's Law was such a convenient weapon (and, as will be seen later, had such useful political connotations) that Ricardo could not resist using it as a reply to Smith. "Adam Smith", he says,

> ". . . uniformly ascribes the fall of profits to the accumulation of capital, and to the competition which will result from it, without ever adverting to the increasing difficulty of providing food for the additional number of labourers which the additional capital will employ. . . . M. Say has, however, most satisfactorily shown that there is no amount of capital which may not be employed in a country, because demand is only limited by production. . . . There cannot, then, be accumulated in a country any amount of capital which cannot be employed productively, until wages rise so high in consequence of the rise of necessaries, and so little consequently remains for the profits of stock, that the motive for accumulation ceases."[1]

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[1] *Works*, pp. 174–175.

As his system developed, and particularly as his theory of value began to assume its central position, Ricardo became more and more convinced of the importance of insisting that a rise in wages was the *sole* cause of a fall in profits. This view was intimately bound up with his belief that value relations in the market ultimately reflected the social relations between man and man in the productive process, and with his conviction that the productive process could be adequately described in terms of human labour without postulating any other " factor of production ". As Mr. Dobb has pointed out, the statement " when wages rise, profits fall " appears on the surface to be nothing more than a tautology. But as employed in Ricardo's system it implied that " profit is uniquely determined by the ratio of the value of labour-power to the value of commodities in general " —a ratio which is approximately equivalent to " the proportion of the labour-force of society which requires to be devoted to the production of the labourers' subsistence ".[1] It follows from this that nothing can permanently lower the rate of profit which does not increase the quantity of social labour which it is necessary to allocate to the wage-goods industries relatively to the quantity allocated to the non-wage-goods industries. Obviously the accumulation of capital will not affect this ratio unless it is associated with increased difficulty in obtaining food—which Ricardo believed would normally be the case. In defending his new theory of profit against Malthus's critique, Ricardo was defending a view of the nature of the economic problem which was of vital importance in his theoretical structure.

It is true, of course, that Ricardo's theory of profit was directly based on his theory of value, and that the latter rested upon the assumption that demand could be considered as a dependent variable in a first approximation to reality. If we take " Say's Law " to be virtually equivalent to this assumption, then we must admit that " Say's Law " in this sense was fundamental to the Ricardian system. But it seems fairly clear that the new school regarded Say's Law as possessing a significance much beyond this. The proposition that demand can safely be treated as a dependent variable in the basic theoretical framework is by no means the same as the proposition that demand in the real world is so closely linked with production that there cannot possibly be a general glut of commodities. It is perhaps significant in this respect that James Mill, in his reply to Spence, should have demonstrated in one place that the part of income destined to be used as capital " is just as completely consumed, as that which is destined for immediate gratification ",[1] and then, a few pages further on, introduced the idea that " the production of commodities creates . . . a market for the commodities produced "[2] as if this were something quite unrelated to his previous argument. The real importance of Say's Law to Ricardo, as to Mill, lay in the fact that it provided a plausible answer to the contention that " there is only a market for a given quantity of commodities, and if you increase the supply beyond that quantity you will be unable to dispose of the surplus ".[3] Looked at in this way Say's Law appears more as something superimposed upon the Ricardian framework than as its " basic premise ".

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[1] M. H. Dobb: *Political Economy and Capitalism*, p. 46.

It is quite understandable that Ricardo should have seized upon Say's Law for assistance in the defence of his theory of profit and in the counter-attack on Malthus's theory of the general glut, when so much was obviously at stake. Once admit that profits could be affected by any factor other than a variation in wages and Ricardo's whole theoretical structure came tumbling to the ground. And once admit that profits might be lowered as a result of accumulation, and the way was immediately laid open for serious criticism of the economic system. Ricardo was never particularly concerned to defend the interests of any single social class except in so far as the interests of that class happened to be bound up with an increase in production,[4] but it would hardly have been possible for his attitude towards the economic system itself not to have been to some extent apologetic. Although the institutional foundations of the system had not yet been seriously called into question in Britain, a tendency was already apparent to explain certain manifest defects in the working of the system in terms of the operation of factors external to it. The appalling poverty among the lower orders, for example, was explained by means of the Malthusian theory of population. A more difficult problem was set by the mysterious "tendency of the rate of profit to fall". If the rate of profit tended naturally to fall as society progressed, and if capital accumulation depended (within certain limits) on the rate of profit, then a boundary seemed to be set to the expansion of social welfare. If accumulation was necessarily attended by the destruction of the motive to accumulate, how could this state of affairs be explained without impugning the system itself ?[1] Ricardo might insist that the stationary state was not a state of stagnation,[2] and that in any event it would not be reached for a very long time, but the doubt remained. Here again an external factor—in this case Nature—was brought in by way of explanation. Not even the best of all possible economic systems could overcome the obstacle of diminishing returns. To economists thinking almost instinctively in such terms, Malthus's suggestion that the system itself was internally defective—if only in the sense that its continued progress required the existence of a vast horde of idlers—must have come as something of a shock,[3] and it is hardly surprising that all the available weapons, including Say's Law, should have been employed against such a major heresy.

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[1] *Commerce Defended*, pp. 71–72. Mill was here answering Spence's contention that national prosperity depended upon the maintenance and increase of the landlords' demand for luxury goods. The traditional *ex post* concept which Mill put forward in reply was, of course, subsequently reformulated in *ex ante* terms and used (quite unjustifiably) as evidence in favour of Say's Law (e.g., by Ricardo, *Works*, p. 175). It is not true, however, that the concept itself necessarily involved Say's Law, any more than the Keynesian equality between savings and investment involves it to-day.

[2] *Ibid.*, p. 81.

[3] *Ibid.*, p. 80.

[4] Cf. Marx, *Theorien* (French Edition), Vol. 4, p. 11.

What requires explanation is not so much Ricardo's enthusiastic support for Say's Law as his insistence that it was fully operative even in the short period. Little damage would have been done to Ricardo's system by a recognition of the fact that over-accumulation might occasionally cause a temporary fall in profit—provided, of course, that the existence of effective long-run corrective tendencies was also recognised. Ricardo's advocacy of a rigid version of Say's Law seems to have been associated with his desire to defend certain political conclusions suggested by his theory. In his 1815 essay he had argued that there were two important counteracting factors which might hinder the long-run tendency of the rate of profit to fall—agricultural improvements and a fall in the price of imported corn.[4] But both improvements (at least in the short run) and an abolition of restrictions upon importation were against the interests of the landlords, since they each led directly to a fall in rents. Thus the theory that profits depended solely upon the value of food implied that " the interest of the landlord is always opposed to the interest of every other class of the community ", since the interests of the other classes obviously lay in checking the " natural " fall in profits as far as this was possible. There is little doubt that Malthus's desire to find an alternative theory of profit which did not involve this unfortunate political conclusion was at least partly responsible for his contention that profits might fall, even though improvements were encouraged and the Corn Laws repealed, if production outstripped consumption. The important point seems to be that Ricardo believed Malthus to have asserted, not only that this *might* happen, but also that it latterly *had* happened.[1] The question at issue, then, was not only an academic one: it was related directly to the thorny problem of the cause of the present distresses. If Ricardo were correct, it followed that the actions of those of his contemporaries who were *at that time* fighting in various ways to weaken the influence of the land-owning interests were supported by the new science of political economy. If Malthus were correct, on the other hand, it followed that they were simply wasting their time. Indeed, their actions might be positively harmful, since if the existence of a class of unproductive consumers was a permanent institutional necessity, then so far from the interests of the landlord being always opposed to those of the rest of the community, the economic health of the rest of the community actually depended upon the wealth and idleness of the landlord. Ricardo and his disciples tended to insist that Say's Law was operative in the short run because in the long run the participants in the contemporary political struggle would all be dead.

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[1] Cf. M. H. Dobb: *op. cit.*, pp. 82–83.

[2] *Letters to Malthus*, p. 189 (letter of 21.7.21).

[3] Ricardo several times complains that Malthus sees "great evils in great powers of production" (e.g., *Letters to Malthus*, p. 188). Ricardo's tone in some of these passages shows how seriously his moral conscience was shocked by Malthus's critique.

[4] *Works*, p. 379. Cf. M. H. Dobb: *op. cit.*, p. 87.

It is true, then, that Say's Law was of great importance to Ricardo and his followers. But it was hardly the " basic premise " of the new school, and an approach which seeks to interpret the history of economic thought in the post-Ricardian period in terms of the victory of Say's Law alone is not likely to prove very fruitful. Obviously some of Ricardo's doctrines survived for many years after his death whereas others virtually perished with him, and any interpretation of the work of his successors, if it is to be meaningful, must account for the defeats as well as for the victories. We have to ascertain not only why Say's Law succeeded, but also why, for example, the labour theory of value (at least as Ricardo formulated it) did not.

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[1] Cf. *Letters to Malthus*, p. 186 (letter of 9.7.21).

II

In Ricardo's own mind there was little doubt as to what constituted the " basic premise " of his system. " I confess it fills me with astonishment ", he wrote to Malthus in 1818, " to find that you think . . . that *natural price*, as well as *market price*, is determined by the demand and supply. . . . In saying this do you mean to deny that facility of production will lower natural price, and difficulty of production raise it ? . . . If indeed this fundamental doctrine of mine were proved false I admit that my whole theory falls with it."[1] By this time Ricardo was fully aware of the crucial position a theory of value must hold in any coherent theoretical system, and had seized upon human labour as the substance, and the only possible measure, of that " facility of production " which determined natural price. It was by no means an easy task for an economist at this time to emancipate his thought from the traditional notion that labour contributed value to its product only per medium of the wages paid to it ; and Ricardo was virtually the first to fashion anything like a consistent theory of value from the notion that it was not the capitalist's expenditure on subsistence goods for his workmen but the expenditure of energy by the workmen themselves which conferred value on commodities.

Behind this fundamental principle there lay a profound sociological assumption. If we have decided to treat demand as a dependent variable and to think of exchange value in terms of cost, there are certain striking aspects of the relationship between modern man and his environment which are likely to induce us to select the expenditure of labour power as the primary and most essential form of cost. In a predominantly agricultural economy there may well be a tendency for both labour and land to be conceived as equally " active " factors in the productive process—labour because it appears to be the indispensable initiator of that process and land because of the " activity " displayed by the regenerative powers of the soil. But in an industrial economy, where by the aid of " ingenious labour " man is able to produce an abundance of material wealth undreamed of in former times, nature begins to be conceived, not as an active co-partner in the business of getting a living, but as little more than a passive sleeping partner.[1] In manufacture it is immediately obvious that man is the dominant partner, but in agriculture nature does not yield her former authority without a struggle. The continued existence of rent seems to prove that nature still " labours along with man " in the fields and pastures. But when it is demonstrated that the existence of rent is due not to nature's beneficence but to her niggardliness, that such assistance as she does give is given in all occupations and not in agriculture alone, and that in any event it is given freely, without any *cost* to man—then the expenditure of human labour is revealed as the only fundamental form of cost or sacrifice common to all branches of production. Human labour begins to appear as the basic, universal and active cost element, always to be found in operation when productive activity results in a value difference between input and output. It seemed to Ricardo that the whole process of production could and should be explained in terms of the disposition and expenditure of the labour power of society. The stock of land was given and unalterable: its existence had *cost* society nothing. The cost of capital goods could be reduced to the quantity of labour expended upon their production in the past. The expenditure of human labour power remained as the basic social cost. The value of the gross national product, then, could be measured by the quantity of living and dead labour embodied in it. To replace this expended labour cost society the amount of labour which it was necessary to devote to the production of subsistence goods for the labourers.[2] The difference between these two quantities of labour measured the net social gain—the surplus or net revenue—resulting from productive activity.

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[1] *Letters to Malthus*, pp. 148–149 (letter of 30.1.18).

The most significant feature of the decade immediately following the death of Ricardo is the extraordinary speed with which these fundamental concepts were removed from the agenda of economic discussion. The years from 1823 to 1833 saw the popularisation (and vulgarisation) of Ricardo's teachings by people like James Mill and McCulloch; they saw the use of Ricardian concepts by radicals and social critics; and they saw the attacks on Ricardo made by a number of those "neglected economists" of whom Professor Seligman reminded us in 1903. By the later 'twenties the most important question was not so much whether Ricardo or Malthus was to prevail on the glut question, as whether Ricardo's system as a whole was to be completely abandoned to the radicals or inoculated against misuse by these individuals by the injection of certain suitable amendments. After a series of energetic controversies "Ricardianism" emerged as the victor over most of the field—but it was hardly the Ricardianism of Ricardo. The basic premise of the system had been thrown overboard. As early as 1829 Samuel Read could refer to "the almost universal rejection of labour as the standard"[1]; and in 1831 Cotterill stated that he felt himself obliged to repeat the usual arguments against the labour theory only because he suspected that "there are some Ricardians still remaining".[2] Ricardo, as Read acutely observed, had believed that "the idea of value in commodities *cannot even be conceived* without being mingled with the idea of their relation to mankind and to human labour, of which *some portion* must always be employed in procuring them originally".[3] It was this vital concept which virtually vanished from English political economy after Ricardo's death. McCulloch was almost the only economist to continue to defend Ricardo's theory of value after 1826, and his defence contained a number of bizarre elements which afforded an easy target for critics.[4]

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[1] Petty's aphorism—" Labour is the Father and active principle of Wealth, as Lands are the Mother "—was probably intended to express this meaning.

[2] The earlier Classical economists tended to ignore the complication afforded by the depreciation of fixed capital.

Interesting evidence of the rapid decline of certain basic Ricardian doctrines is to be found in the proceedings of the Political Economy Club. If, as Mr. Checkland suggests, the founding of the Club was an act by which the "excellent tacticians " of the new school sought " to consolidate their advantage ", one can only say that they were not very diligent in following up this " political act ". Early in 1831, Torrens put forward the following question for discussion: " What improvements have been effected in the science of Political Economy since the publication of Mr. Ricardo's great work; and are any of the principles first advanced in that work now acknowledged to be correct ? " The question was debated on January 13th and April 15th, 1831, and Mallet has left us an account of the discussions. Torrens apparently held at the first meeting " that all the great principles of Ricardo's work had been successively abandoned, and that his theories of Value, Rent and Profits were now generally acknowledged to have been erroneous ". Bailey had settled the question of value and Thompson that of rent; and Ricardo's omission to take account of the replacement of fixed capital " was decisive of the unsoundness of his views " on profit. McCulloch agreed that Ricardo's theory of profit was defective, but energetically defended his theories of value and rent. Tooke supported Ricardo only on the question of rent. At the adjourned meeting it seems to have been generally admitted that Ricardo's theories of value, rent and profit, although incorrect " according to the very terms of his propositions ", were " right in principle ". There follows in Mallet's account an important catalogue of Ricardo's errors:

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[1] Samuel Read: *An Inquiry into the Natural Grounds of Right, etc.*, p. 203.

[2] C. F. Cotterill: *An Examination of the Doctrine of Value, etc.*, p. 8.

[3] Read: *Inquiry*, p. viii, footnote (Read's italics).

[4] In much of his work on value and profit theory McCulloch seems to have been relatively unaffected by the contemporary drift towards apologetics. But in his attitude towards a number of other matters which Ricardo considered of great importance he definitely deserted the Ricardian camp—e.g., the machinery question, the distinction between productive and unproductive labour, and the question of the conflict of class interests. Cf. *Letters to McCulloch*, p. 136; and see also the Centenary Volume of the Political Economy Club (Vol. VI, 1921), p. 254.

> " He is one of the first who has treated the subject of Taxation, and he always reasons out his propositions, whether true or false, with great logical precision and to their utmost consequences; but without sufficient regard to the many modifications which are invariably found to arise in the progress of Society. One of the errors of Ricardo seems to have been to have followed up Malthus' principles of population to unwarrantable conclusions. For, in the first place it is clear from the progress of social improvement and the bettering of the condition of the people in the greater part of the civilised world, that Capital, or the means of Employment—the fund for labour—increases in a greater ratio than population; that men generally reproduce more than they consume, and the interest of the capital besides, which surplus goes to increase the fund for labour. Then he

> looks forward from the gradual demand for food and the use of land, to the gradual lowering of wages and profits till nothing remains but rent to the Landlords. But long before that, modification would take place in the state of society which would make such conclusions all wrong. First of all, it is contended that the interest of the Landlords does in fact coincide with those of the other classes; and then we see that in Ireland, where rent is absorbing everything, in consequence of the immense competition for land, a system of Poor Laws is likely soon to equalise the division."[1]

What was the reason for the rapid decline of these fundamental Ricardian concepts—a decline suggested not only in this debate, but also in the mass of economic literature which flooded the market at this time? The early reaction against Ricardo, I think, was in large measure due to a widespread feeling that important elements of his system set limits to the prospects of human progress under capitalism, and therefore could not possibly be true. In particular the work of the "Ricardian socialists" revealed certain disharmonious and pessimistic implications of Ricardo's system so forcibly that the economists of the day could hardly avoid being influenced by it in the course of their revaluations of Ricardo.

A significant number of economists was at this time becoming conscious of the fact that the labouring classes were beginning to think for themselves and to question the ethical validity of the foundations of the social structure. In his *Elements of Political Science*, published in 1814, John Craig could remark that "the fear of levelling is altogether chimerical".[2] In the first edition of Mrs. Marcet's *Conversations* (1816) we find Mrs. B. denying that she would teach political economy to the labouring classes.[3] Yet only ten or twelve years later Mrs. Marcet is to be found vying with Harriet Martineau in the composition of economic fairy tales of a wholesome moral character for the enlightenment of the proletariat. It would appear that it was not Mrs. Marcet who changed in the intervening years, but rather the labouring classes themselves. So long as the labouring classes are passive and ignorant their views on political economy can be ignored. But when it becomes no longer possible to prevent them from listening to Mr. Hodgskin at a Mechanics' Institute the situation has radically changed. The fear of levelling is no longer chimerical. Evidence that the seriousness and importance of this change were widely appreciated is to be found in the works of many economists of the period, but by no one were the facts more cogently stated, and the new tasks facing political economy more admirably summarised, than by Mountifort Longfield in 1833:

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[1] Centenary Volume of the Political Economy Club, pp. 35, 36 and 223–225. I am indebted to Professor Hayek for drawing my attention to these passages.

[2] John Craig, *Elements of Political Science*, Vol. II, p. 230.

[3] *Conversations on Political Economy*, p. 158.

> "It is daily becoming more important, that the notions which are generally entertained should be correct, since they now lead so directly to action. . . . No person can now remain altogether neutral, and avoid such topics. He must, according to the degree of pains he has taken with the subject, be a teacher of useful truth, or a disseminator of mischievous falsehood. Opinions . . . exercise immense influence on a class of people formerly removed beyond the reach of such discussions. . . . I allude to the labouring orders, both agricultural and manufactural. It is no longer a question, whether these men shall think or not, or what degree of influence their opinions ought to exert over their conduct; they will follow the path where they conceive their interests to point, and it only remains to be considered, in what manner a true sense of their real interests may be most effectually brought home to them. The change has taken place, whether for the better or the worse it is useless now to enquire, since the steps which have led to it can never be retraced. The people will no longer be guided by the authority of others. . . . It depends in some degree upon every person present, whether the labourer is taught that his interest will be best promoted by prudence and industry, or by a violent demolition of the capital destined for his support."[1]

It is evident, too, that the majority of economists were very much aware of the dangerous use to which a number of radical writers were putting certain orthodox economic concepts. To the extent that the arguments of the radicals were taken up by the working-class movement and used as weapons in its day-to-day struggles, the claim to the whole produce of labour—or even to a greater proportion of the produce of labour—appeared as a monstrous assault on the very foundations of civilised society. The work of men like Charles Hall and Piercy Ravenstone might be safely ignored; but Hodgskin's *Labour Defended*, born as it was of the working-class activity which followed the repeal of the Combination Laws, could not be so easily passed over.[1] In a number of cases Hodgskin was attacked directly. The American economist Thomas Cooper wrote in 1830:

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[1] Longfield: *Lectures on Political Economy*, pp. 16–18.

> "The modern notions of Political Economy among the operatives or mechanics are stated, but not very distinctly, by Thomas Hodgskin in his treatise on *Popular Political Economy* . . . . . If these be the proposals that the mechanics combine to carry into effect, it is high time for those who have property to lose, and families to protect, to combine in self-defence."[2]

Charles Knight's edifying work, *The Rights of Industry*, published in 1831 under the superintendence of the Society for the Diffusion of Useful Knowledge, seems to have been aimed directly at Hodgskin and had a very wide influence. Samuel Read obviously considers Hodgskin and others like him who flatter and persuade the workers "that they produce all" as the main enemies against whom his reasoning is directed[3]; and Scrope finds "truly unaccountable" the blindness of Hodgskin and all others who "declaim against capital as the poison of society, and the taking of interest on capital by its owners, as an abuse, an injustice, a robbery of the class of labourers!"[4]

It is hardly too much to say that every new development in economic thought in England about this time had the objective effect of cutting the ground from under the feet of writers like Hodgskin and William Thompson. And at least in some cases there can be little doubt that the critics of Ricardo knew exactly what they were doing and why they were doing it. Scrope, for example, was disarmingly frank about the motives which originally led him to the study of political economy. "At the time of the passing of the first Reform Bill", he wrote in 1873, "it became evident that the power of directing the Legislation of Britain was about to pass . . . from the hands of the few into those of the many". Wishing to estimate the probable results of this change upon "the social destinies of the country", Scrope endeavoured to ascertain "what were the notions likely to prevail among the masses, when they became the repositories of supreme power, with regard to the principal institutions of modern society". What lessons in this respect, he asked himself,

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[1] Francis Place drew attention to the interesting fact that Hodgskin's ideas attracted large numbers of disillusioned Owenites. B.M., Place Add. Mss., 27,791, f. 263.

[2] Thomas Cooper: *Lectures on Political Economy*, 2nd edition, pp. 350–353.

[3] Read: *Inquiry*, pp. 125–132, xxix, etc.

[4] G. P. Scrope: *Principles of Political Economy* (1833), pp. 150–151. See also the amusing passage in a review of some of Senior's lectures in the *Edinburgh Review*, Vol. 48, September 1828, p. 170 *et seq.*

> ". . . were they likely to imbibe from the current doctrines of Political Economy? Were these lessons fitted to reconcile them to the hardships of a condition of almost ceaseless toil for, in many cases, but a meagre subsistence; and this in a country overflowing with wealth enjoyed in idleness by some at the expense (as it might at first sight appear to them) of the labour of others? On examination of the works of the most noted Economists of that day, Messrs. Ricardo, Jas. Mill, Maculloch, Malthus, Chalmers, and Whateley, I could not discover in them any answer likely to satisfy the mind of a half-educated man of plain commonsense and honesty who should seek there some justification for the immense disparity of fortunes and circumstances that strike the eye on every side. On the contrary, these works appeared to me to contain many obvious inconsistencies and errors, to inculcate many false and pernicious principles, and certainly to be little adapted to the purpose which I looked for in them."[1]

Approaching political economy in this spirit, it is hardly surprising that Scrope should have been the first British economist to propound a consistent version of the abstinence theory.[2] Samuel Read was another who understood perfectly well that Ricardian political economy led logically to radicalism. His refutation of the "mischievous and fundamental error" of the "Ricardo economists" (i.e., their doctrine that "labour is the only source of wealth") consists largely of an endeavour to put forward as many apologetic theories of profit as possible, regardless of consistency.[3] And Longfield, finally, was surely quite as fully aware of the political and ethical implications of his theory of distribution as was J. B. Clark of his some sixty years later. It seems not unfair to say that economists like Scrope, Read and Longfield, in varying degrees, tended towards the view that if a doctrine "inculcated pernicious principles", if it denied that wealth under free competition was consigned to its "proper" owners, or if it could be so interpreted as to impugn the motives or capacity of the Almighty, then that doctrine must necessarily be false. Their fundamental approach, in other words, was determined by a belief that what was socially dangerous could not possibly be true.

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[1] *Political Economy for Plain People*, Preface.

[2] *Quarterly Review*, January 1831, Vol. XLIV, p. 18.

[3] *Inquiry*, p. xxix and *passim*.

To say that the work of Hodgskin and his fellows had more to do with the innovations of the period than it is at present fashionable to admit is neither to deny the great originality and importance of some of the new contributions nor to assert that the *majority* of their authors were consciously indulging in apologetics. The writings of Bailey, West, Lloyd and Longfield possess an interest and significance which are not purely historical, and remain as important landmarks in a period of great anticipations. But surely something more than mere intellectual curiosity must be postulated to account for the iconoclastic attitude adopted towards Ricardo's system by so many of the innovators. As I have suggested above, this attitude would seem to have been largely due to a feeling that any theory which suggested that the possibilities of progress under capitalism were limited could not be true. Hodgskin frankly admitted that he disapproved of certain of Ricardo's doctrines because they seemed "to set bounds to our hopes for the future progress of mankind in a more definite manner even than the opinions of Mr. Malthus"[1]; and J. S. Reynolds wrote in 1822 that "it would not be difficult to trace Mr. Ricardo's theory to consequences inconsistent with the goodness of Providence, and to the scheme of Divine government".[2] An optimistic era in which prosperity appears to be increasing—and in which basic social institutions are coming under fire—has no use for theories which encourage criticism by setting limits. Such theories seem not only to be dangerous, but also to contradict the actual living experience of the age.

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[1] Letter to Place of May 28th, 1820. B.M., Place Add. Mss., 35,153.

[2] J. S. Reynolds: *Practical Observations on Mr. Ricardo's Principles*, p. 15.

It did not take long for most of the pessimistic theories to fall into disuse. In 1835 Mallet reports that "the whole artillery of the Club" was directed against Malthus's principle of population.[1] As early as 1831, as we have seen, the Club seems to have agreed that the interest of the landlord was not in fact in conflict with the interests of the other social classes, and also that the doctrine of the stationary state required radical amendment. In the early 'thirties it was widely suggested that industrial experience had proved Ricardo's theory of the inverse relationship between wages and profits to be false, since wages and profits might and often did increase together. The Ricardian concepts of value as embodied labour and profit as a surplus value, which had proved so useful to the radicals, were among the first to be rejected: value began to be conceived in terms of utility or cost of production or sometimes (as with Bailey) as little more than a mere relation; and profit came to be explained not as the result of something which the labourer did but as the result of and reward for something which either the capitalist or his capital did. John Stuart Mill, growing up in this new atmosphere, found no difficulty in incorporating Senior's abstinence concept into his system and substituting a rather superficial cost of production theory of value for Ricardo's labour theory. Ricardo's system, in short, was purged of most of its more obviously disharmonious elements, particularly those which might have been used to suggest that there was a real conflict of economic interest between social classes under capitalism or that progress under capitalism might be limited for some other reason. Ricardo's disciples, like the later followers of Quesnay, threw overboard their master's most essential principles while still claiming to speak in his name. Say's Law, with its optimistic implications, was one of the doctrines which survived the purge, and it was no doubt largely as a result of these implications that it achieved an importance in the neo-Classical system far beyond that which it possessed in Ricardo's theory.

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[1] The difference between the motives which led to the wide acceptance of the Malthusian theory and those which led to its eventual rejection is very striking.

The Analogy Between Producer and Consumer Equilibrium Analysis

PART I

OUTLINE OF THE PROBLEM AND CONCLUSIONS

By H. MAKOWER

1. Recent developments in the theory of equilibrium for an individual consumer have led to the general acceptance of the following proposition: the effect of a change in the price of a consumer good upon the quantity consumed may be split into two elements, the Income Effect and the Price Effect.[1] It is sometimes said that producer analysis is not parallel to consumer analysis in this respect.[2] The object of this note is to show that, on the basis of certain fundamental assumptions regarding the limitation of resources, producer analysis is parallel to consumer analysis. We shall show that a change in the price of a factor of production upon the quantity employed may be split into the "substitution effect" and the "resources effect", the latter being analogous to "income effect" in consumer analysis.

2. The procedure will be to draw the parallel to the analysis of the consumer's equilibrium as given in Mr. Hicks' *Value and Capital* Mathematical Appendix (Sections 7 and 8) and Chapter II.

3. Here it should be pointed out that Mr. Hicks' textual treatment (Chapter II) of the substitution term in Slutzky's *Fundamental Equation of Value Theory* is not, as Professor Mosak has shown,[3] identical with his treatment in the Mathematical Appendix. The two passages give slightly different interpretations of the substitution effect. Professor Mosak gives a diagrammatic representation of the consumer's

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[1] *See* J. R. Hicks: *Value and Capital*, Mathematical Appendix, p. 309.

[2] *See*, for instance, *Value and Capital*, p. 90. "Therefore, in the case of production, we do not have anything similar to the income effects which gave us so much trouble in utility theory."

[3] *Studies in Mathematical Economics and Econometrics*, pp. 69–73. Professor Mosak remarks that the two interpretations can be reconciled only if the difference between them can be taken as an infinitesimal of a higher degree.

equilibrium which is in agreement with the interpretation given in Mr. Hicks' Appendix, and hence differs from Mr. Hicks' diagrammatic representation. This point has its application not only to consumer analysis, but also to producer analysis: and in following through the parallel (on the producer's side) to the consumer analysis, reference will be made to a type of diagram corresponding to the treatment given by Mr. Hicks in his Appendix (p. 309) and not to the diagram used by Mr. Hicks himself in his text (p. 31).

4. The analysis of the effect of a change in the price of a consumer good upon the quantity of that good consumed, is founded upon the following hypotheses:

(*a*) The consumer has an *initial endowment* of consumer goods. That is, he has given physical quantities of goods (or a given quantity of money) which he can freely trade against other goods on the market. The quantity of some goods may be zero but not of all. Mr. Hicks calls this initial endowment the consumer's "income". The whole problem is entirely indeterminate if initial income is not fixed (and fixed in terms which are independent of price).

(*b*) The consumer has given tastes expressed by the indifference function; the function relates physical quantities of consumer goods.

(*c*) Two alternative prices of one good in terms of the other(s) are postulated. These prices are assumed to be independent of quantity consumed (perfect market).

(*d*) It is assumed that the consumer maximises his utility and that second-order maximum conditions hold throughout.

From these data follow:

(i) The equilibrium quantities of goods consumed with the initial price.

(ii) The equilibrium quantities of goods consumed with the new price.

(iii) The demonstration of the possibility of inferior goods.

(iv) The analysis which splits up the changes in quantity caused by a price change into two parts: that ascribed to the Substitution Effect and that ascribed to the Income Effect.

and for all cases where the number of goods exceeds two:

(v) The analysis of complementarity and substitution, i.e., the analysis of the effect upon the consumption of one consumer good when the price of another consumer good is varied.

5. The parallel analysis for the production side, on the simplifying assumption that there are only two factors of production[1] and one final product, runs as follows:

(*a*) The producer has an *initial endowment* of factors of production. That is, he has given physical quantities of factors (or a given quantity of money capital) which he can freely trade against other factors on the market.

(*b*) The production function connecting different quantities of output with different quantities of factors is technically given. This function relates physical quantities of factors and output, output being available *after* input.[2]

(*c*) Two alternative prices for factors of production (and hence implicitly for final product) are then postulated. These prices are assumed independent of quantities bought or sold (perfect competition).

(*d*) It is assumed that the entrepreneur maximises his utility and that second order maximum conditions hold throughout.

From these data follow:

(i) The equilibrium quantities of factors and output with the initial price.

(ii) The equilibrium quantities of factor and output with the new price.

(iii) The demonstration of the possibility of inferior factors.

(iv) The analysis which splits up the changes in quantity caused by a price change into two parts: "Substitution Effect" and "Resources Effect". (This latter is the name we give to the parallel, on the production side, to Income Effect.)

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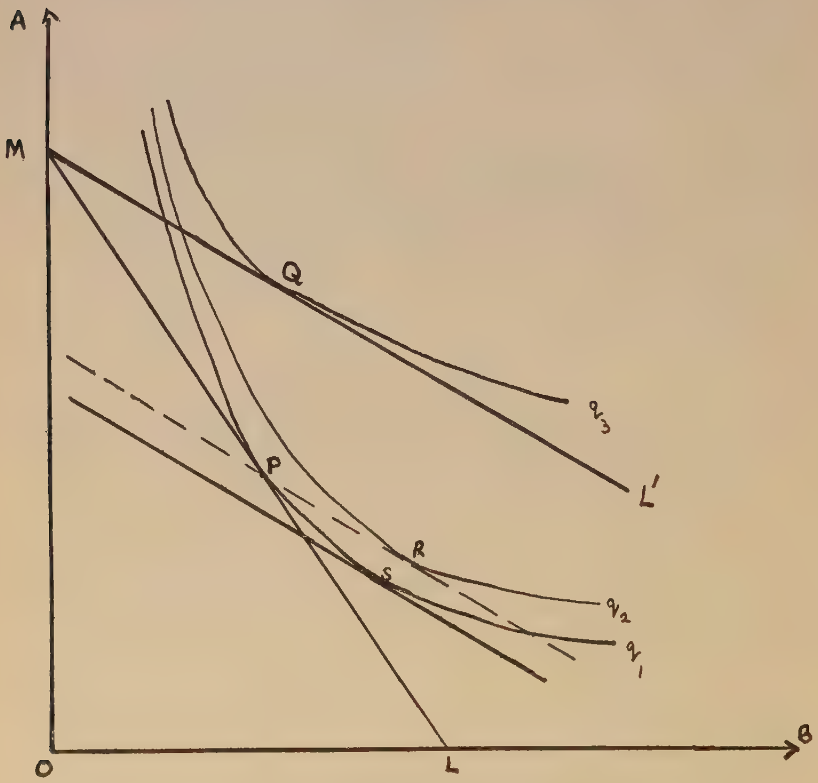
[1] I.e., two physically different factors belonging to one time period. They might also be one physical type of factor belonging to two different periods; but in this case one ought to introduce different time periods for the final product also, i.e., to drop the assumption of only one final product.

[2] Even on the assumption of two factors belonging to one time period, time must be assumed to elapse before the final product is obtained. Without such a time lag there would be no effective limit on resources. Thus we are forced to recognise time in production analysis, whereas it is possible to ignore it in consumption analysis.

Points (iii) and (iv) may be elucidated diagrammatically. Let OA and OB measure the quantities of the two factors A and B. Let the curves q_1, q_2, q_3 represent production isoquants for the final product. Let initial resources be OM of A[1], and let the initial price of A in terms of B be given by the slope of ML. Then equilibrium is at the point of tangency between ML and an isoquant—that is, at P. Now consider the effect of a change in price to the slope of ML′. The new equilibrium will be at the point of tangency between ML′ and an isoquant—that is, at Q.



The Substitution Effect of the change in price may be isolated by conceiving price to change from the initial to the new level while resources are held constant. The definition of "constant resources" under conditions of changing factor prices is that the collection of physical resources chosen by the entrepreneur at the new price should have the same value as the collection chosen before the price change, *using the new price for valuation in both cases*. Thus in the Figure, the Substitution Effect is measured by the movement from P to R.

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[1] If initial resources consist of production "opportunities" representing different combinations of A and B, this can be inserted into the diagram by drawing an opportunity curve (concave to the origin) which touches ML tangentially.

The Resources Effect of the change in price may be isolated by conceiving resources to change, so as to bring the entrepreneur to the new (equilibrium) production level, price being constant at the new level throughout. In the Figure the Resources Effect is measured by the movement from R to Q[1].

It will be noted that the convexity of the curves q_1, q_2, q_3 . . . . is not a sufficient condition to ensure that the point Q lies to the right of R. That is, it is possible that a factor may be inferior. Moreover, it is conceivable that Q may lie to the left of P. That is, a fall in the price of a factor may reduce the quantity employed.

The above description of the Resources and Substitution Effects in Production is similar to that appropriate to consumer analysis *mutatis mutandis* (replace the two factors by two consumer goods, and the production curves by indifference curves).

6. Analysis taking into account more than two factors and more than one kind of output.

An analysis with only two factors of production is little use since, if the two factors are two different physical items (labour and land) the analysis must exclude a central feature of production: the capital market, with its borrowing possibilities and the phenomenon of interest. Alternatively, if the two factors are thought of as "this year's labour and next year's labour" this excludes the whole technical relationship between different physical types of productive factor.

In order to broaden the analysis so that it can deal, even in principle, with these two basic aspects of production, it is necessary to work with at least three factors. (The analysis of substitution and complementarity relationships between factors enters at this stage.) Finally, in order to generalise the analysis so that it applies to production of more than one type of consumer good, it is necessary to introduce into the analysis the entrepreneur's system of preferences for final consumer goods.[1] Once this has been done, the distinction between production analysis and consumption analysis disappears, and the two are merged into the study of the producer-consumer. But such a general analysis, involving many variables, requires mathematical treatment of the kind given in Professor Baumol's following paper.

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[1] In this exposition the Substitution Effect has been taken first, and the Resources Effect afterwards. The analysis can equally well be done in the reverse order: in that case, in isolating the Substitution Effect, resources are held constant in terms of their value at the *initial* price. Similarly, in isolating the Resources Effect, the price should be held constant at the *initial* level throughout. On this question of reversing the order of the analysis, see Mosak, *op. cit.*, Figures 1 and 2.

This difference in the measurement of the Substitution and Resources Effects arising from the *order* of decomposing the total effect of a price change into its two components is quite distinct from the difference between Mr. Hicks' textual interpretation and that given in his mathematical appendix. This should be clear from Mosak's article (though he does not explicitly mention that the difference in interpretation affects the Income as well as the Substitution term).

7. CONCLUSION

(i) The effect of a change in the price of a factor may be decomposed into two elements one of which (substitution component) is always negative and the other of which (resources component) may be either negative or positive. Since in the general case there is no further limitation on the sign or magnitude of these elements, it is conceivable that a rise in the price of a factor might cause the producer to increase his employment of that factor.

(ii) A change in the price of a factor may affect the relative quantities of that and other factors in any direction, in the absence of restricting assumptions regarding the form of the production function. If there is a strong positive Resources Effect, an increase in the price of a factor may increase the relative (and even the absolute) quantity of that factor employed compared with other factors. If the Resources Effect is negative, an increase in the price of a factor will decrease the absolute quantity employed ; the effect on the relative quantity will depend on the complementarity-substitution relationship between this and other factors.

(iii) In spite of the highly abstract nature of this analysis, there might be an interesting practical application of it if the Resources Effect is in fact positive in the case of very poor entrepreneurs. For example, in the case of a small peasant farmer, might an increase in the price of cheap farm labour lead to an increased demand for it ?

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[1] Except where the relative prices of all consumer goods are constant.

PART II

INCOME EFFECT, SUBSTITUTION EFFECT, RICARDO EFFECT[1]

By WILLIAM J. BAUMOL

I

In the detailed algebraic micro-analysis of the firm it is usually assumed that competition is perfect, and that as a result the firm can purchase inputs without limit (for practical purposes) at a fixed price.[2] Cash (the loan of purchasing power) is usually included among the inputs that can be obtained thus. Now, as a matter of fact I think it is considerably more realistic to assume that firms are limited in purchasing power, either in the sense that increased credit can, after a point, be obtained only at increasing cost, or that it cannot be obtained at any price because at any moment the firm can only borrow up to a level determined by the trust with which the money market regards it. Largely because of analytic difficulties analogous to those leading to the adoption of the premise of perfect competition in most such discussions, I adopt the latter, absolute money capital limit, assumption.

With the aid of this premise, several interesting conclusions can be deduced. For one thing, it is usually argued that an increase in the price of one input alone will *always* result in a reduction in the quantity of the item employed. But this is because it is taken that there are no limits to the firm's resources (purchasing power), and so the untoward income effect of the theory of the consumer is not present here to provide the basis for a " Giffen Paradox ". However, with limitation of money capital to the firm, in the sense that the firm's expenditure on at least some of its resources is effectively subject to some limit, so that it must budget its payments, the income effect returns again, as I shall now attempt to show.

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[1] The basic idea of the first part of this paper is entirely Dr. Makower's. Professor Hayek has been exceedingly kind and helpful in the work on the Ricardo effect. I am also indebted to Mr. Graaff for his invaluable advice given while he was himself working on a similar problem, and much of the argument of Part II is based on his suggestions.

[2] True, it is sometimes specified that there is some "factor" limited in quantity to prevent the production function being effectively linear and homogeneous in the inputs so that the diminishing returns required for the second-order maximum conditions may be obtained. *See*, e.g., J. R. Hicks : *Value and Capital*, p. 322. Here I prefer to follow Samuelson in ignoring " factors " of this sort, whose quantity is not generally measurable (*The Foundations of Economic Analysis*, pp. 854–5). Cf. Professor Chamberlin's " Proportionality, Divisibility and Economies of Scale ", *Quarterly Journal of Economics*, February 1948, and the discussion in the same journal, February 1949.

In the argument I shall employ three basic assumptions :

1. That aside from (effective) limitation of money capital competition is in every sense perfect.
2. That the entrepreneur's sales, price and other expectations are unique and definite (although they may be represented by figures which have been discounted for risk) and
3. That the entrepreneur seeks to maximise something which we shall call his utility, and which is about to be described.

It is usually assumed that the entrepreneur seeks to maximise the capitalised present value of the stream of his expected profits (surpluses). This is a usable concept when money can be borrowed and loaned in indefinitely large quantities at a fixed rate of interest, for then the opportunity cost of receiving a unit of money at some future date rather than in the present is the interest lost by not having the amount now. We can therefore evaluate the present value of expected future returns and sum them (having thus rendered money receivable at different dates comparable) to obtain the capital value of the stream of expected profits.

With effective rationing of capital, however, the rate of interest paid on the money borrowed does not measure the firm's loss in postponement of receipts, since the firm cannot borrow as much as it wants and its loss in not having more cash now must be greater than the interest cost of borrowing. Thus there arises a difficulty in measuring the capitalised present value of the stream of expected profits.

It might at first seem that the solution is to calculate the loss in profits resulting from the postponement of the opportunity to invest a unit of currency which is received later rather than now, and to base our discount on this loss. That this solution is spurious can, however, be seen when we consider that the profit opportunity loss must be defined as the most valuable of the streams of surpluses which could have been obtained had the unit of currency been available now, and the value of these streams can only be computed and (in general) compared *after* the appropriate discount factors have been found.

The solution must then be a recourse to the entrepreneur's scale of preferences, his ordinal utility function U, arbitrary up to any monotone transformation. We thus assume that the entrepreneur acts so as to maximise his utility.

Here, there arises another problem. We may consider that the entrepreneur seeks to maximise the utility of his stream of surpluses, or we may consider him as a consumer and assume that he maximises the utility of the goods which he buys for his personal use. In a formal sense, the latter is more general since we may visualise the entrepreneur spending everything on the single commodity (money), and then the analysis following from the use of the former assumption can readily be made into a special case of the discussion employing the latter.

Let us now write $X_{ti} = -Y_{ti}$ and P_{ti}, respectively, for the quantity and price of *input* i in period t, if $i = 1, 2, \ldots . s$. Also let these represent the quantity and price of the i^{th} good *purchased by the entrepreneur for his own consumption* during that period when $i = s+1,\ s+2, \ldots, m$. Finally let Y_{ti} and P_{ti} represent the quantity and price of the i^{th} *output* during period t if $i = m+1,\ m+2, \ldots, n$.

Note that one of the items in question may be money, and that physically similar goods may appear simultaneously as inputs, consumers' goods and outputs.

We now assume that the entrepreneur maximises his utility,[1]

$$(1) \qquad U = U(X_{01}, \ldots\ldots, X_{hn}),$$

subject to the limitations imposed on him by the transformation function and his money capital limitations given by conditions (2) and (3) below. Here h is the economic horizon, i.e., the number of periods ahead for which the entrepreneur makes his plan.[2]

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[1] Strictly speaking, (1) should perhaps be written $U = U(X_{os+1}, \ldots\ldots X_{hm})$ (entrepreneurial utility depends *only* on his consumption) but for symmetry and simplicity of notation I write it as above, where we may take it that $\frac{\partial U}{\partial X_i} \equiv 0$ for $i = 1, 2, \ldots\ldots, s, m+1, m+2, \ldots n$. I employ a similar notational device for the transformation function.

[2] Of course, everything left at the end of period h must be considered as part of the entrepreneur's personal consumption.

The transformation function is given by

(2) $\mathcal{T}(X_{01}, \ldots\ldots, X_{hn}) = 0.$

Cash or other highly durable goods held are of course transformed into the same quantities of the same items in the next period.

The money capital limitations of the firm are given by

(3) $\sum_{i=1}^{n} X_{ti}P_{ti} = R_t, \qquad t = 0, 1, \ldots, h,$

when R_t is the net borrowing permitted the firm during period t. We may prefer, as a special case, to take $R_t = 0$ for $t = 0$ so that the borrowing of the firm all takes place initially. Condition (3) of course states that the excess of payments for purchases of inputs and consumers' goods (including cash) over receipts from the sale of outputs (including sales to himself) must be equal to borrowing during any period.[1]

Now the first-order conditions for maximisation of (1) subject to (2) and (3) are given by (2), (3) and

(4) $U_{ti} + A\mathcal{T}_{ti} + k_tP_{ti} = 0, \qquad i = 1, 2, \ldots n; \quad t = 0, 1, \ldots h,$

where we write

$$U_{ti} = \frac{\partial U}{\partial X_{ti}},\ U_{tisj} = \frac{\partial^2 U}{\partial X_{ti}\partial X_{sj}},$$

$$\mathcal{T}_{ti} = \frac{\partial \mathcal{T}}{\partial X_{ti}} \text{ and } \mathcal{T}_{tisj} = \frac{\partial^2 \mathcal{T}}{\partial X_{ti}\partial X_{sj}},$$

and where A and k_t are Lagrange multipliers. Now to find the effect of change in one of the prices or expected prices, or in the entrepreneur's money resources, R_t, during any period t we differentiate (4), (2) and (3) totally, in that order and get

(5) $\sum_{s,j}[U_{tisj} + A\mathcal{T}_{tisj}]\,dX_{sj} + \mathcal{T}_{ti}dA + P_{ti}dk_t = -k_tdP_{ti}, \qquad i = 1, \ldots, n; \ t = 0, 1, \ldots\ldots, h,$

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[1] Mr. Graaff has drawn my attention to the danger that in certain circumstances (3) will not provide true budget restraints. Thus, if inputs in a given period affect only output in the same period (zero turnover period), output is so to speak, self-financing, and the firms' operations are not limited by money borrowing limitations. Moreover, the form of the restraint by itself suggests that output may effectively be financed by negative consumption in some periods, and clearly the utility function must be made such as to preclude this possibility. We do not, of course, preclude the possibility that some inputs have a negligible turnover period and so are not effectively limited to the firm. The restraint (3) may also easily be modified to cover the case where money capital for investment in some assets, e.g., especially liquid assets, is not effectively limited for the firm, so long as there is a group of inputs for which the firm has not all the purchasing power it would like.

$$(6)\qquad \sum_{t,i} T_{ti} dX_{ti} = 0, \text{ and}$$

$$(7)\qquad \sum_{i} P_{ti} dX_{ti} = dR_t - \sum_{i} X_{ti} dP_{ti}, \qquad t = 0, 1, \ldots h.$$

Here (5), (6) and (7) are $nh + 2h + 2$ linear equations in the same number of variables dX_{ti}, dk_t and dA. Write D for the determinant of the system and $D_{(ti)(sk)}$ for the cofactor of the element in its $(ti)^{\text{th}}$ row and $(sj)^{\text{th}}$ column, where items are ordered lexicographically,[1] e.g., if $h = 1$ and $n = 3$ the X_{ti}'s are arranged in the order X_{01}, X_{02}, X_{03}, X_{11}, X_{12}, X_{13} and $D_{(02)(11)}$ is the cofactor of the element in the second row and fourth column of D. For the cofactor of the element in the *eighth* row (note that D is a 9th order determinant) and *fourth* column, we write in this case $D_{(8)(11)}$.

The solution of the system then gives, by Cramer's Rule,

$$(8)\qquad dX_{sj} = \frac{-\sum_{t,i} k_t dP_{ti} D_{(ti)(sj)} + [dR_t - \sum_{i} X_{ti}\, dP_{ti}] D_{((h+1)n+1+t)(sj)}}{D},$$

so that

$$(9)\qquad \frac{\partial X_{sj}}{\partial P_{ti}} = -k_t \frac{D_{(ti)(sj)}}{D} - X_{ti} \frac{D_{((h+1)n+1+t)(sj)}}{D},$$

and in particular

$$(10)\qquad \frac{\partial X_{ti}}{\partial P_{ti}} = -k_t \frac{D_{(ti)(ti)}}{D} - X_{ti} \frac{D_{((h+1)n+1+t)(ti)}}{D}$$

and

$$(11)\qquad \frac{\partial X_{sj}}{\partial R_t} = \frac{D_{((h+1)n+1+t)(sj)}}{D}.$$

Thus the second term on the right-hand side of (9) and (10) represents the *ceteris paribus* change in expendable money resources in period t resulting from the increase in P_{ti}, and might by analogy with the income effect in the theory of consumer's behaviour be termed the resources effect. In general there is nothing we can say about its sign.

The first terms on the right of (9) and (10) are then the substitution effects, and these are, as we might expect, well behaved in sign; that is to say the first term in (10) is always negative, so that a rise in its price always makes for a reduction in the purchase of an input or consumers' good, or an increase in the quantity of an output (for which, of course, X_{ti} is defined to be negative).[1]

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[1] See, e.g., A. C. Aitken: *Determinants and Matrices*, p. 90.

This can be seen as follows. The second order conditions for maximisation of U subject to (2) and (3) require[2]

$$\frac{D_{(ti)\,(ti)}}{D} < 0. \tag{12}$$

Moreover, $-k_t$ may be interpreted to be the marginal utility of money capital in period t, i.e., $\frac{dU}{dR_t}$. For we have

$$\frac{dU}{dR_t} = \sum_{s,j} U_{sj}\frac{\partial X_{sj}}{\partial R_t} = \sum_{s,j} U_{sj}\frac{D_{((h+1)n+1+t)\,(sj)}}{D} \tag{13}$$

by (11). Then by (4)

$$\frac{dU}{dR_t} = -A\sum_{s,j} T_{sj}\frac{D_{((h+1)n-1-t)\,(sj)}}{D} - \sum_{s} k_s \sum_{j} P_{sj}\frac{D_{((h+1)n+1+t)\,(sj)}}{D}. \tag{14}$$

Comparison with (7) in its relation to D shows that all of the terms on the right-hand side of (14) except

$$-k_t \sum_{j} P_{tj}\frac{D_{((h+1)n+1+t)}}{D} = -k_t\frac{D}{D} = -k_t \tag{15}$$

are zero since they represent expansions of D by false cofactors, i.e., by multiplying the elements of some other row by the cofactors of the corresponding elements of the $(h+1)n+1+t^{\text{th}}$ row. This and substitution from (15) into (14) gives

$$\frac{\partial U}{\partial R_t} = -k_t > 0 \tag{16}$$

if the firm is taken (as it must be with effective limitation of money capital) to prefer a *ceteris paribus* increase in the money capital available to it in period t. Thus (16) together with (12) make the first term on the right-hand side of (10) negative, giving the well behaved substitution term we require.

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[1] Actually, these results are not completely general. Where the price whose change we consider is that of a product, i, transformed (used as a raw material or produced) by our entrepreneur and this is at the same time a good, j, consumed by him (so that $P_i \equiv P_j$), we get a different result. Then the substitution term in $\frac{\partial X_k}{\partial P_i} = \frac{\partial X_k}{\partial P_j}$ becomes the sum of the terms representing the substitution of k for i and that representing the substitution of k for j. The reader should have no difficulty in showing that this substitution term will no longer be symmetrical, as is the case with the ordinary substitution term. That is, this term in $\frac{\partial X_k}{\partial P_i}$ will not be the same as the substitution term in $\frac{\partial X_i}{\partial P_k}$. Furthermore, the sign of the substitution term in (10) becomes ambiguous. Some exceedingly interesting implications of such a result have been most elegantly indicated by Mr. Graaff in an unpublished paper.

[2] See, e.g., Samuelson: *Foundations of Economic Analysis*, Appendix A.

Our substitution term may readily be shown to have all the standard properties of the substitution term in the ordinary theory of consumer behaviour. Moreover, if we write for the substitution term

$$S_{(ti)(sj)} = -k_t \frac{D_{(ti)(sj)}}{D},$$

then in addition to, but similar to Mosak's[1] condition (4), i.e.,

$$\sum_{t,i} P_{ti} S_{(ti)(sj)} = 0,$$

we easily obtain (by Mosak's argument) the $h+1$ conditions

$$(17) \qquad \sum_{i} P_{ti} S_{(ti)(sj)} = 0, \qquad t = 0, 1, \ldots\ldots, h.$$

Similarly, in addition to Mosak's condition (5), i.e.,

$$\sum_{(ti) \neq (sj)} P_{ti} S_{(ti)(sj)} > 0$$

we have

$$(18) \qquad \sum_{i \neq j} P_{si} S_{(si)(sj)} > 0.$$

This arises, of course, because of the multiplicity of side conditions (3) relevant to the theory of the firm, and which are substituted for the one budget restriction in the theory of consumer behaviour. The strict analogues of Mosak's (4) and (5) clearly follow from (17) and (18) by summation. There is no point in repeating the oft discussed interpretation of these properties here. We may merely note that (18) states that there must be a certain amount of substitutability among the relevant items (inputs, outputs and consumer's goods) not just over the plan as a whole, but also in any one period.

II

An extension of the preceding analysis appears capable of providing a test of the Ricardo effect. Indeed it seems strange that the extensive discussion of this effect[2] consists largely of a dispute as to the realism of the assumptions which it was suspected would lead to the results. Little formal analysis seems to have been attempted to see whether the conclusions do indeed follow from the premises in question, this despite the obvious importance of the hypothesis to business cycle analysis.

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[1] J. Mosak: *General Equilibrium Theory in International Trade*, pp. 23–6.

[2] See F. A. Hayek: *Individualism and Economic Order*, Ch. XI for references on this topic and for an exposition of Professor Hayek's thesis.

First, what is the Ricardo effect ? Originally employed by Professor Hayek to explain the fall in the demand for capital goods at the end of a boom, it is argued that in certain circumstances a *ceteris paribus* rise in output prices will lead firms to decrease their demands for more durable (more capital-like) inputs relative to their demand for less durable inputs, i.e., it will induce them to make their production less capital-intensive. Now it is generally acknowledged that such a result may sometimes follow with inelastic price expectations, for then an output price rise must mean a relative rise in present as compared to expected future output prices, and so a relative fall in the demand for those inputs (i.e., capital goods) tending more than others to augment future outputs.

But the essence of the Ricardo effect is that it is supposed to work independently of expectations. The basic premise is that the money capital of firms is limited, and it is argued that a rise in output prices should serve as an inducement for increasing the turnover of the effectively limited money capital and thus lead to a lower capital-intensive investment.

Now a complete non-mathematical analysis of this proposition seems exceedingly difficult, if not, in practice, impossible. For, as we have seen, the firm's money capital limitations require recourse to such complications as an entrepreneurial utility function rather than now generally inapplicable constant rates of discount. Moreover, an argument in terms of the situation in a single period is necessarily inadequate to take care of such essential features of the problem as rates of turnover. Nor can we assume with any sort of generality that outputs, inputs, etc., will continue at a constant per period rate and so confine ourselves to the analysis of the events of one of these identical periods. The possibility that the firm will be unable to increase its borrowing after the initial period or that it may accumulate some money thereafter, precludes this approach. Thus a mathematical analysis appears to be essential.

A completely general proof might still be rather nasty. However, it turns out that a moderately simplified model suffices to show that there appears to be little reason, in general, to expect the Ricardo effect to work as described.

In our model we assume an $h\,(h > 3)$ period horizon as before. There is one (composite) entrepreneurial consumer good of which M_t is consumed in period t. There is one output produced in quantity Z_t in that period, and a non-durable (labour) input bought in quantity L_t in period t for $t \neq h$, which affects output only in the period after the one in which it is purchased.[1] Since the entrepreneur must be taken to treat assets remaining at the horizon as part of his consumption, any investment in labour in period h may be included in M_h. There is also a durable capital good bought in quantity C_t in period $t\,(t < h - 1)$ and which affects outputs in periods $t + 1$ and $t + 2$. Since any of this input bought in period $h - 1$ affects output in only one period before the horizon it must be treated as a non-durable input and included in $L_h - 1$. Any of its usufruct remaining in period h, as well as any capital purchase in period h, must, like a labour good purchase in that period, be treated as entrepreneurial consumption, and included in M_h after suitable choice of units.

For notational convenience the units of our inputs and consumption good are so chosen in each period that their unit price is equal to unity, and the units of the output are chosen so that its initial unit price is P in all periods considered. Since in examining the Ricardo effect we take all prices other than output prices to remain fixed, and (to prevent a pseudo-Ricardo effect arising via inelastic expectations) we take present and all expected future output prices to vary in proportion (unit elasticity), this choice of units involves no loss of generality.

Our system is then given by the entrepreneur's utility function

$$(1) \qquad U(M_0, \ldots\ldots, M_h) = U,$$

and one production function for each period

$$(2) \qquad Z_t = {}_t T(L_{t-1}, C_{t-1}, C_{t-2}) \qquad t = 0, 1, \ldots\ldots h$$

where it should be understood that $L_h = C_h = C_{h-1} = 0$ and L_{-1}, C_{-1}, and C_{-2} are all constants determined by past decisions, so that Z_0 is also a constant similarly determined. We also have the firm's budget restraints

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[1] We may assume the output to be perishable to prevent the labour factor affecting output (sales) in the more distant future.

$$(3) \qquad R_t + PZ_t = M_t + L_t + C_t,$$

where R_t is the firm's borrowing in period t.

We could proceed to operate with this system directly, but it is convenient first to eliminate the Z_t's by substituting from (2) into (3) to obtain the restraints

$$(4) \qquad R_t + (P)_t\mathcal{T}(L_{t-1}, C_{t-1}, C_{t-2}) = M_t + L_t + C_t, \qquad t = 0, 1, \ldots, h.$$

We then assume that the entrepreneur seeks to maximise his utility subject to (4). The first-order conditions are given by (4),

$$(5) \qquad U_t - k_t = 0, \qquad t = 0, 1, \ldots\ldots h,$$

$$(6) \qquad k_t(P)_t\mathcal{T}_L - k_{t-1} = 0,$$

and

$$(7) \qquad k_{t+1}(P)_{t+1}\mathcal{T}_D + k_t(P)_t\mathcal{T}_C - k_{t-1} = 0,$$

where the k_t's are Lagrange multipliers, and we use the notation

$$\frac{\partial U}{\partial M_t} \equiv U_t, \quad \frac{\partial_t\mathcal{T}}{\partial L_{t-1}} = {}_t\mathcal{T}_L, \quad \frac{\partial_t\mathcal{T}}{\partial C_{t-1}} = {}_t\mathcal{T}_C \text{ and } \frac{\partial_t\mathcal{T}}{\partial C_{t-2}} = {}_t\mathcal{T}_D$$

as well as $\dfrac{\partial U}{\partial M_s \partial M_t} = U_{st}$, $\dfrac{\partial_t\mathcal{T}}{\partial L_{t-1}\partial C_{t-1}} = {}_t\mathcal{T}_{LC}$, etc.

Total differentiation of (5), (6), (7) and (4) gives

$$(5a) \qquad \sum_s U_{ts}dMs - dk_t = 0,$$

$$(6a) \qquad k_tP[{}_t\mathcal{T}_{LL}dL_{t-1} + {}_t\mathcal{T}_{LC}dC_{t-1} + {}_t\mathcal{T}_{LD}dC_{t-2}] + {}_t\mathcal{T}_LPdk_t - dk_{t-1} = -{}_t\mathcal{T}_Lk_tdP,$$

$$\begin{aligned}(7a) \qquad & k_{t+1}P[{}_{t+1}\mathcal{T}_{DL}dL_t + {}_{t+1}\mathcal{T}_{DD}dC_{t-1} + {}_{t+1}\mathcal{T}_{DC}dC_t] \\ & + k_tP[{}_t\mathcal{T}_{CL}dL_{t-1} + {}_t\mathcal{T}_{CD}dC_{t-2} + {}_t\mathcal{T}_{CC}dC_{t-1}] \\ & + {}_{t+1}\mathcal{T}_DPdk_{t+1} + {}_t\mathcal{T}_CPdk_t - dk_{t-1} \\ & = -[{}_{t+1}\mathcal{T}_Dk_{t+1} + {}_t\mathcal{T}_Ck_t]dP\end{aligned}$$

and

$$\begin{aligned}(4a) \qquad & -dM_t + (P)_t\mathcal{T}_LdL_{t-1} - dL_t + (P)_t\mathcal{T}_DdC_{t-2} + (P)_t\mathcal{T}_CdC_{t-1} - dC_t \\ & = -dR_t - {}_t\mathcal{T}dP\end{aligned}$$

From which we get by Cramer's rule (where D is the determinant of the system)

$$(8) \qquad \frac{\partial L_s}{\partial P} = -\sum_t \Big[{}_t\mathcal{T}_L k_t \frac{D_{h+2+t,\, h+2+s}}{D} + ({}_{t+1}\mathcal{T}_D k_{t+1} + {}_t\mathcal{T}_C k_t) \frac{D_{2h+3+t,\, h+2+s}}{D} + {}_t\mathcal{T} \frac{D_{3h+4+t,\, h+2+s}}{D}$$

The expression for $\frac{\partial C_s}{\partial P}$ is clearly identical with the R.H.S. of (8) except that $D_{t,\, 2h+s+3}$ is substituted for $D_{t,\, h+s+2}$ throughout.

Now the Ricardo effect is the assertion that $\frac{\partial \left(\frac{C_s}{L_s}\right)}{\partial P}$, i.e., that

$$(9) \qquad L_s \frac{\partial C_s}{\partial P} - C_s \frac{\partial L_s}{\partial P}, \qquad 1 < S < h - 1$$

is negative (capital intensity of input rises with price). If we substitute into (9) from (8) and the analagous expression for $\frac{\partial C_s}{\partial P}$ we obtain a linear homogeneous expression in some of the $\frac{D_{ij}}{D}$ with coefficients

$$-L_s\, {}_t\mathcal{T}_L k_t, \quad -L_s[{}_{t+1}\mathcal{T}_D k_{t+1} + {}_t\mathcal{T} n_C k_t], \qquad -L_s\, {}_t\mathcal{T},$$
$$C_s\, {}_t\mathcal{T}_L k_t, \quad C_s[{}_{t+1}\mathcal{T}_D k_{t+1} + {}_t\mathcal{T}_C k_t] \qquad \text{and } C_s\, {}_t\mathcal{T}.$$

Now we assume, on economic grounds, that L_s, the input of labour in period, s, C_s, the input of capital in that period, ${}_t\mathcal{T}_L$, the marginal product of labour in period t, ${}_t\mathcal{T}_C$, the marginal product of new capital in that period, ${}_{t+1}\mathcal{T}_D$, the marginal product of old capital in the next period, ${}_t\mathcal{T}$, output in period $\mathcal{T}$, and k_t, the marginal utility of consumption in period t (by (5)), are all positive. Hence the first three coefficients listed are negative, the other three positive, and *all of them unrestricted in magnitude.*[1] But among the $\frac{D_{ij}}{D}$ which appear in (9) there are $\frac{D_{h+s+2,\, h+s+2}}{D}$ and $\frac{D_{2h+s+3,\, 2h+s+3}}{D}$, both of which must be negative if the second-order maximum conditions are to be satisfied. Hence the terms in which these appear, i.e.,

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[1] Indeed, it is clear that the relative and absolute values of these items, e.g., the marginal products and inputs of labour and capital and the marginal utility of capitalists' consumption will vary immensely from industry to industry and from firm to firm.

$$C_s\,{}_s\mathcal{T}_L k_s \frac{D_{h+s+2,\,h+s+2}}{D}, \text{ and}$$

$$-L_s[{}_{s+1}\mathcal{T}_D k_{s+1} + {}_s\mathcal{T}_C k_s]\frac{D_{2h+s+3,\,2h+s+3}}{D}$$

must be respectively negative and positive, and unrestricted in magnitude. It follows that so long as the second-order maximum conditions hold, the sign of (9) is ambiguous, no matter what the type of utility or production functions.[1]

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[1] In models involving a small number of periods it is not difficult to prove the other terms ambiguous in sign, without recourse to second order maximum conditions. The argument is, however, tedious and seems unnecessary.

Mr. Harrod on Hump Saving

By J. de V. Graaff

"The fundamental theory of the supply of saving", says Mr. Harrod,[1] "may be set out in the form of equations". This note is concerned with the particular form in which Mr. Harrod proceeds to set these equations out, and with the way in which he interprets them. But if, in consequence, a large part of it is devoted to a rather critical discussion of some of his results, we should not let this divert our attention from the importance of the problem to which he has chiefly applied them. Very briefly, Mr. Harrod investigates whether or not there is any automatic regulator (such as the rate of interest) which can be relied upon to maintain the stability of an advancing economy. He concludes that there is not. The argument of the present note in no way casts doubt upon the validity of this general conclusion.

Mr. Harrod distinguishes between two broad types of personal saving. First, there is the saving a man does for his heirs—*saving for posterity*. The second he terms *hump saving*. Hump savings are savings a man makes only in order to be able to spend at some later stage of his life—in order to secure for himself that distribution of consumption through time that maximises his utility, discounted to the present. The term "hump" is appropriate because, broadly speaking, a man may be expected to accumulate assets during youth and middle age to provide for his retirement and senescence. If he calculates correctly, and desires to leave nothing for posterity, he will dissipate these assets at such a rate that their exhaustion coincides with his death. The curve depicting the time path of the volume of his assets will therefore be humped. It is the reaction of the area under this curve—of the hump itself—to changes in the rate of interest that Mr. Harrod investigates. He is led to conclude that the size of the hump is likely to grow as the rate of interest rises.

Before examining the validity of this conclusion, it might be as well to dispose of the first element in personal saving :

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[1] R. F. Harrod: *Towards a Dynamic Economics*, (London, 1948), p. 41.

saving for posterity. Very little can be said about its relation to the rate of interest. It is true that when the rate rises a man's *power* to save, and therefore to bequeathe, rises too. But it may well be that his *desire* to bequeathe diminishes. Why should he strive to leave his heirs as large a capital sum when the rate it will yield them is 6 per cent. as when it is 3 per cent.? Because of considerations of this sort, it is convenient to follow Mr. Harrod in discussing the problem of hump saving as though the representative man had no desire to leave to posterity anything at all.

Now we are ready for the equations. Let us adopt the following notation :—

C_k = consumption planned for year k.

Y_k = income, apart from the fruits of past saving, expected in year k.

R = the number of pounds to which, at the current rate of interest, one pound accumulates in one year.

T = the number of units of present utility equally preferred with one unit of utility a year hence.[1]

$U(C_k)$ = total utility of consuming the amount C_k. (U is assumed to remain the same from year to year—it does not depend upon k explicitly.)

u_k = marginal utility of consuming the amount C_k.

$$\epsilon = \frac{u_1}{C_k} \cdot \frac{C_1 - C_k}{u_k - u_1}$$

That is to say, ϵ is the average elasticity[2] (over the relevant range) of the curve giving the marginal utility of consumption. (It is *not*, as Mr. Harrod seems inclined to say,[3] the average elasticity of the *income* utility curve.)

n = number of years our representative man expects to live.

We shall adopt the convention that income (interest and non-interest) is received, consumption expenditure incurred and assets acquired at the beginning of each year; and that the interest earned by such assets is received at the beginning of the following year. Constant prices are assumed throughout.

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[1] It should be noted that T is not, as Professor Higgins has said in a review of Mr. Harrod's book, the reciprocal of the rate of time preference. Cf. B. Higgins: "Towards a Dynamic Economics", *The Economic Record*, XXIV, No. 47 (December, 1948), p. 178.

[2] There is, of course, no unique formula for measuring "arc-elasticity". ϵ has been defined in this particular fashion since it seems to lead to results more closely akin to Mr. Harrod's than those to which alternative definitions give rise.

[3] *Op. cit.*, p. 41. I have taken the liberty of altering Mr. Harrod's notation to the extent of writing ϵ for his e.

Now in Mr. Harrod's model the representative man is assumed to foresee his death at the end of the nth year, and to plan to dissipate all his savings during the last years of his life. Thus his total consumption during the n years must be planned to equal his total income, including interest on savings. That is to say:

$$(1) \qquad \sum_1^n C_k = \sum_1^n Y_k + \sum_1^{n-1} (Y_k - C_k)(R^{n-k} - 1)$$

He is also assumed to maximise the total utility, discounted to the present, of his consumption. Therefore he must maximise, subject to (1), the expression:

$$\sum_1^n U(C_k) T^{k-1}$$

The first-order conditions for a maximum are:

$$(2) \qquad u_k T^{k-1} + \lambda R^{n-k} = 0 \qquad (k = 1, 2, \ldots, n)$$

where λ is a Lagrange multiplier. (1) and (2) together give us $(n+1)$ equations to determine the n C_k and λ. In particular, for $k=1$, (2) yields:

$$(3) \qquad \lambda = -u_1 R^{1-n}$$

So the equations (2) become:

$$(4) \qquad u_k T^{k-1} = u_1 R^{1-k} \qquad (k = 1, 2, \ldots, n)$$

Recalling our definition of ϵ, and substituting in (4), we get without difficulty:

$$(5) \qquad C_1 = C_k[1 - \epsilon(1 - (TR)^{1-k})] \qquad (k = 1, 2, \ldots, n)$$

Equations (1) and (5) are the ones Mr. Harrod would appear to be aiming at.[1] He gives, however, two slightly different ones,[2] without any details of their derivation, which does not seem to have been correctly performed.

His procedure is next to examine the effect of changes in the rate of interest on the size of the hump, ϵ and T being given "a wide range of values within the bounds of probability".[3] These bounds are apparently 0 and 1 for ϵ, and

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[1] *Op. cit.*, p. 42.

[2] Mr. Harrod's two equations are:

$$C_1 = C_k\left(1 - \epsilon\left(1 - \frac{1}{(TR)^k}\right)\right)$$

and $(C_1 + \ldots + C_n) - (Y_1 + \ldots + Y_n) = (Y_1 - C_1)R^{n-1} + \ldots + (Y_n - C_n)R^0$.

[3] *Op. cit.*, p. 49.

0.96 and 1 for T. On the legitimacy of this procedure we shall have more to say in due course. But, accepting it for the moment, does Mr. Harrod's conclusion—his "rather surprisingly decisive"[1] result that the hump grows with the rate of interest—follow?

Let us take the simplest possible case, where our representative man expects to die at the end of the second year. Then $n = 2$, and equations (1) and (5) reduce to:

$$(1') \qquad C_2 = Y_2 + (Y_1 - C_1) R$$

and $$(5') \qquad C_1 = C_2(1 - \epsilon + \epsilon / TR)$$

If, to simplify still further, we put $Y_1 = 1$ and $Y_2 = 0$, we can eliminate C_2 between (1′) and (5′) to obtain:

$$(6) \qquad C_1 = \frac{R(1 - \epsilon + \epsilon / TR)}{1 + R(1 - \epsilon + \epsilon / TR)}$$

Now the hump is just $(Y_1 - C_1)$, or $(1 - C_1)$. Thus:

$$(7) \qquad \text{Hump} = \frac{1}{1 + R(1 - \epsilon) + \epsilon / T}$$

It is clear from (7) that, if we are to believe Mr. Harrod that ϵ lies between 0 and 1, the hump must diminish as R rises; whereas, if $\epsilon > 1$ it will grow with the rate—for the coefficient of R in the denominator is then negative. These are precisely the reverse of Mr. Harrod's results. His conclusion that the hump is likely to grow with the rate of interest must therefore be regarded with suspicion.

It can fairly be argued, however, that our "simplest possible case" is very far from being a typical one—especially since our representative man expects to die too soon for accrued interest to enter into the hump. All that our simple case can show is that Mr. Harrod's conclusion is not universally valid. It has shown nothing about its usefulness as a broad generalisation. But a mathematical examination of the second-order conditions for a maximum indicates quite clearly that no broad generalisation of this sort is justified: a number of much more typical cases can be constructed in which the hump fails to behave as Mr. Harrod says it should. These second-order conditions are not very neat, however, and no good purpose would be served by setting them out in this context, for there are at least four other (and quite separate) scores on which Mr. Harrod's treatment seems to be open to criticism :—

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[1] *Op. cit.*, p. 49.

(i) Firstly, what particular significance attaches to changes in the size of the hump, as opposed to changes in the flow of savings in any one year ? The answer to this question seems to have been provided by F. P. Ramsey.[1] He reasoned that a community with a stationary population can be divided up into a number of classes, the men in each class being identical in all respects, but having their birthdays spread out evenly over the course of a lifetime. If there are *m* men in one such class, the total volume of assets held by the whole class will be *m* times the average held by any one of its members during the course of his life. Now Mr. Harrod's contention is that the hump, the *total* volume of assets held by one man during the course of his life, will respond positively to a change in the rate of interest. Since the length of the man's life is unaffected by changes in the rate, it follows that the *average* volume of assets he holds must also respond positively. Thus, if Mr. Harrod's contention were correct, the total volume of assets held by any one class, and therefore by all classes in the community, would rise with the rate of interest. That is to say, in such a community *the supply curve of saving could not be backward-rising.*

This would be a powerful and interesting conclusion were it not for the two very restrictive assumptions, which (in addition to Mr. Harrod's dubious contention) are required for its truth. These are that the population be stationary, and that the men in any one class be " identical in all respects ". The first does not fit very snugly into a theoretical discussion of dynamic problems ; and the second involves the important corollary that the men in any one class must face the same rate of interest throughout their entire lives. This means that when the rate changes we must wait the full period of a lifetime before we can apply the Ramsey method of argument. It therefore represents a rather awkward approach to dynamic problems—for if the rate were to change frequently, let alone continuously, we might never be able to apply it at all.

Thus there does not seem to be much point in discussing what will happen to the size of a man's hump when the rate changes. The important question to ask is: what happens to the amount he saves in any particular year? If we can answer this question for each man in a community, we can get without further difficulties what happens to the aggregate amount saved by the community in that year—which is what we want to know. To enquire into the reaction of the hump is to pursue a very red herring.

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[1] F. P. Ramsey : " A Mathematical Theory of Saving ", *Economic Journal*, 1928, p. 558.

(ii) Secondly, there is the familiar Keynesian line of criticism that the most important influence of the rate of interest on the volume of saving is likely to be via the level of business activity, the level of income and the distribution of income. And if the rate has any appreciable effect on business activity it is inconceivable that a change in it should be unaccompanied by a revision of at least some men's expectations regarding income in future years. This would have an important reaction on the amount they saved.

(iii) Thirdly, Mr. Harrod's results do not provide us with simple (or even complicated) relations between observable quantities like consumption, income or the rate of interest. They run instead in terms of non-observables like ϵ and T. Thus we saw, in interpreting equation (7), that the response of the hump to changes in the rate of interest depended upon whether or not ϵ was less than one. Mr. Harrod is apparently of the opinion that "if it is found that a rise of piece rates causes a man to work less hard, we can infer that for him $\epsilon < 1$".[1] There are two separate sources of confusion here. Firstly, Mr. Harrod confuses the elasticity of the curve showing the marginal utility of *income* (which is what, with an additional assumption, he would be obtaining information about) with the curve showing the marginal utility of *consumption* (which is what he requires for his analysis). The additional assumption referred to constitutes the second source of confusion. For Mr. Harrod's statement to be true it is necessary that the marginal disutility of work be independent of the man's total income.[2] This is patently improbable—for work involves the sacrifice of leisure, and the utility derived from a marginal increment of leisure is intimately dependent upon total income.

The ingenious scheme Mr. Harrod proposes[3] for determining ϵ empirically by mutual adjustments of a standard rate and

[1] *Op. cit.*, p. 43. ϵ has been substituted for Mr. Harrod's e.

[2] Cf. A. C. Pigou: *The Economics of Stationary States* (London, 1935), pp. 292–5.

[3] *Op. cit.*, pp. 43–44.

a bonus rate of wages is, for the same two reasons, quite inadmissible.[1]

Since Mr. Harrod's results run largely in terms of non-observable quantities, they do not easily yield propositions we can test and (if necessary) refute. In the terminology made familiar to economists by Professor Samuelson,[2] they are not meaningful results. No result is meaningful unless it is capable of being tested against the facts it purports to explain.

(iv) Mr. Harrod for some reason believes that T is likely to lie between 0.96 and 1.[3] On the possibility of ever being able to obtain an estimate of "the number of units of present utility equally preferred with one unit of utility a year hence" it is inappropriate to say more at the moment. A question which might well be posed, however, is this: Will there be any time preference at all under the assumptions of Mr. Harrod's model? For these assumptions seem to include virtually complete certainty: the representative man knows exactly when he will die, and what income he is to receive in future years. It is rather a nice problem whether or not there would be any discounting of the future if the future were known with complete certainty. It is not, however, a problem to which we can ever hope to provide an answer—it is not really a meaningful question to ask.

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[1] Economists who have been impressed by the method of measuring "utility" (on an arbitrary scale, and from an arbitrary origin) which has been devised by Professors von Neumann and Morgenstern in their *Theory of Games and Economic Behaviour* (Princeton, 1944; esp. pp. 15–31 and appendix to second edition), may wonder if this might not provide a fruitful alternative method of measuring ϵ. The answer is that it does not. The von Neumann-Morgenstern approach is based on the hypothesis that when a man is confronted with choices involving risk, he will seek to maximise the mathematical expectation of his "utility". The two major premises in the treatment are (*a*) that a man maximises the mathematical expectation, rather than some other characteristic expression, of a set of quantities when confronted with choices involving risk; and (*b*) that these quantities can justifiably be identified with the utility of classical economic analysis. Neither premise is particularly secure. Professors von Neumann and Morgenstern are aware that (*a*) excludes the possibility of there being any specific "utility" or "disutility" attached to gambling or risk-bearing, as such. It would seem better, therefore, to call the von Neumann-Morgenstern "utility" *nutility*, and to say that there is no nutility attached to gambling or risk bearing—for to use "utility" in such a way that none can attach to these two activities is to depart rather far from the traditional usage.

This is but one example of a difficulty frequently encountered when the axiomatic approach is employed (and it is very extensively employed in the *Theory of Games*). The difficulty arises because, when one has axiomatised a concept, it is often by no means easy to find the intuitive counterpart of the concept which satisfies one's axioms. Thus, to identify the nutility measured by the von Neumann-Morgenstern method with the utility of classical analysis is to make a very big jump.

[2] P. A. Samuelson: *The Foundations of Economic Analysis* (Cambridge, Mass., 1947), *passim*.

[3] *Op. cit.*, p. 51.

II

In conclusion, it is perhaps worth while to emphasise that Mr. Harrod's model is but one of a large number of fairly plausible models. Consider, for instance, the following one—which, while rather more general, remains open to a number of the criticisms we have just advanced against Mr. Harrod's. Let us adopt the following notation, again assuming constant prices.

$c(t)$ = consumption planned for time t.
$y(t)$ = non-interest income expected at time t.
$a(t)$ = volume of assets planned to be held at time t.
r = force[1] of interest, assumed constant.
p = force[1] of time preference, assumed constant—it varies with neither wealth nor time horizon.
$U(c)$ = consumption utility function.
$V(a)$ = utility function indicating the amenity yield of assets.
t_1 = expected time of death.
a_0 = volume of assets held initially—i.e., at time $t = 0$.

Our representative man is now assumed to choose that consumption stream, $c(t)$, and that asset stream, $a(t)$, which will maximise his total utility, discounted to the present. That is to say, he is assumed to maximise the integral:

$$\int_0^{t_1}(U(c)+V(a))e^{-pt}dt$$

(8) where $a(t)=\int_0^t (y(z)-c(z))e^{r(t-z)}dz$

This is a problem in the calculus of variations. The first-order condition for a maximum is simply that $c(t)$ and $a(t)$ must satisfy, in addition to equation (8), the relation:

(9) $$e^{(r-p)t}\frac{dU}{dc}=\int_t^{t_1} e^{(r-p)z}\frac{dV}{da}dz$$

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[1] These two forces are related to the annual rates by a simple formula—e.g., if i is the annual rate of interest $r=\log_e(1+i)=i-i^2/2+\ldots\ldots$
or $i=e^r-1=r+r^2/2!+\ldots$

Differentiating (9) with respect to t, we obtain without difficulty:

$$\text{(10)} \qquad \frac{dc}{dt} = \frac{\dfrac{dV}{da} + (r-p)\dfrac{dU}{dc}}{\dfrac{-d^2U}{dc^2}}$$

If we assume that the marginal utility of consumption diminishes, the denominator of (10) is positive, and the sign of the numerator determines the sign of dc/dt. That is, the sign of the expression formed by adding to the marginal amenity yield of assets $(r-p)$-times the marginal utility of consumption determines whether consumption is planned to grow, remain constant or diminish through time. Since the marginal amenity yield of assets, the marginal utility of consumption, the rate of interest and the rate of time preference are all positive, we can at once derive at least one testable theorem from (10).[1] We can say that *a sufficiently high rate of interest can always secure that consumption be planned to rise through time.* This is a testable, refutable theorem because it gives a relation between observable quantities—for in the model plans are assumed to be put into effect.

It is rather interesting that the theorem should be in terms of the rate of increase of consumption, rather than the level of consumption. This is, however, what we should expect of a dynamic theory.[2] But we are nevertheless entitled to ask if anything can be said of the reaction of the level of consumption to a change in the rate of interest. Unfortunately, no meaningful generalisation seems to be possible. If a man holds a large volume of assets a rise in the rate they yield may so increase his interest income that he increases his consumption both in the present and in the future; whereas, under different circumstances, it may stimulate him to postpone consumption till the morrow, diminishing it to-day. This is, of course, a very familiar conclusion.

A rather similar remark applies to the influence of the rate of interest on the flow of saving, da/dt. It does not seem possible to derive simple testable theorems on this matter from the assumptions of the model. Under some circumstances a rise in the rate stimulates a man to save more, under others it makes it unnecessary for him to save so much. The task of defining these circumstances in terms of observable quantities awaits fulfilment. Until it is successfully undertaken we should beware of attempts such as Mr. Harrod's, or even Professor Higgins'[1]—to take short cuts to the solution.

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[1] Further testable theorems are likely to follow from the second-order conditions.

[2] Harrod: *op. cit.*, pp. 1–14.

Cambridge.

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[1] *Loc. cit.*

Two Reports on Population

By E. Grebenik[1]

During the 'thirties there was considerable interest in and discussion of the population problems facing Great Britain. The decline in the number of births first forecast as early as 1895 by Edwin Cannan[2] had gone on for sufficiently long to raise public anxiety, and a number of projections were published indicating that the population of Britain would shortly begin to decrease.[3] The general public became aware of the problem of sub-replacement fertility, and public discussion resulted in the passage of the Population (Statistics) Act in 1938, which reorganised the system of British official vital statistics and provided for the collection of information necessary for the detailed analysis of fertility.

The outbreak of war naturally led to a decrease in interest in population problems. During the early years of the war the number of births decreased, as was expected, but from 1942 onwards there was a surprising recovery. The annual number of legitimate births in Great Britain exceeded 740,000 every year since 1942, the average figure for 1935–8 being 697,000, and in 1944 and 1946–8 the net reproduction rate rose above unity.

In 1944, when births were increasing, but when the trend had not yet been the subject of public discussion, the Government appointed a Royal Commission whose terms of reference were "to examine the facts relating to present population trends in Great Britain, to investigate the causes of these trends and to consider their probable consequences: to consider what measures, if any, should be taken in the national interest to influence the future trend of population and to make recommendations ". The Commission issued its Report in June 1949.[1] About a year earlier Political and Economic Planning had published the report of its Population Policies Group.[2] The appearance of these two reports makes it opportune to examine to what extent the emphasis in the discussion of population problems has shifted since pre-war days and to assess the problem as it stands to-day.

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[1] The author wishes to state that though he was employed for two years in the secretariat of the Royal Commission on Population, his duties were entirely confined to technical statistical work on the Family Census, and that he did not participate in drafting or preparatory work on the Report.

[2] E. Cannan: "The Probability of a Cessation of the Growth of Population in England and Wales during the next Century", *Economic Journal*, December 1895: reprinted in *Economic Scares*, London, 1933.

[3] For a select bibliography of these projections, cf. D. V. Glass: *Population Policies and Movements in Europe*, Oxford, 1940, Appendix pp. 468–472. The forecasts of Dr. Enid Charles in particular received a good deal of publicity; cf. E. Charles, "The Effects of Present Trends in Fertility and Mortality upon the Future Population of Great Britain and upon its Age Composition. Reprinted in *Political Arithmetic* (Ed. L. Hogben), London, 1938.

I. THE PROBLEM OF MEASUREMENT

The first question which arises concerns methods of analysing past population trends and of appreciating the probable future movement of the population. It is necessary to assess the significance of war-time fluctuations in births and to determine whether the recent increase which has brought the reproduction rate above replacement level for the first time since the early 'twenties is likely to be permanent. The techniques employed in studying these problems have changed considerably since pre-war days.

Since 1938 data have been collected in Great Britain which make it possible to calculate the net reproduction rate. The rate, with which the educated public had become familiar, is obtained by calculating the number of live girl children which a newly-born female would bear, if throughout her reproductive period she was subject to current rates of fertility, as measured by age-specific fertility rates, and mortality, as measured by the current life-table. It has been demonstrated[3] that if these rates continue unchanged the population will settle down to stability, i.e., it will have a fixed age composition and a steady rate of annual increase or decrease, which will be related to the net reproduction rate.[4] A net reproduction rate above unity would mean that the population would ultimately increase, and conversely, a net reproduction rate below unity would imply an ultimately decreasing population. In that sense the net reproduction rate is an index of replacement, but as it is based on annual age-specific fertility rates which may fluctuate considerably, the interpretation of a series of rates some of which are below and others above unity may present a considerable amount of difficulty.

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[1] Royal Commission on Population: Report. Cmd. 7695. H.M.S.O. London. June 1949, pp. xii + 259. 4s. 6d.

[2] *Population Policy in Great Britain.* A Report by P.E.P., London, 1948, pp. 227. 18s.

[3] A summary of the theory will be found in A. J. Lotka, *Analyse démographique avec application particulière à l'espèce humaine.* Paris, 1939. The Registrar General uses a variant, the so-called Effective Reproduction Rate in which an allowance is made for the likely future decline in mortality.

[4] Dr. P. H. Karmel in an unpublished doctoral thesis has generalised and extended the Lotka theory, by assuming certain rates of marriage, marriage dissolution, legitimate fertility, etc. The continuation of these rates at the same level will lead to a population which will be stable not only in age composition, but also in marital status. The theory can be extended to take account of any number of other rates. Cf. P. H. Karmel: *The Measurement of Reproductivity in Relation to the Conflict between Male and Female Measures.*

There is no doubt that should the net reproduction rate continue below unity for a considerable period, the population will ultimately cease to grow, but even then the amount of the probable decrease and the time when total numbers will begin to fall cannot be predicted on the basis of net reproduction rates alone.

In the past population projections have generally been based on age-specific fertility rates.[1] Trend lines of one kind or another were fitted to these rates and births were projected from these trends. This technique has yielded useful results in the past because during a transition period from a large to a small family system, there was a well-defined trend in these age-specific rates and the trend was more important than short-term variations about it. As the trend becomes less pronounced the difficulties connected with extrapolation increase. In the last analysis the main factor which at present determines population movement (if migration is excluded for the time being) is the size of families that married couples have during their reproductive period. It has been shown[2] that a constant ultimate family size is quite consistent with sharp annual fluctuations in fertility rates. Married couples to-day can and do space their children. Economic depressions, wars, and other upheavals may cause them to postpone births which they hope to " make up " later on. In a year in which conditions improve the annual number of births may therefore be swollen considerably, because in addition to the ' normal ' births of that year, there will be an addition of ' postponed ' births which are being ' made up '. Age-specific fertility rates and net reproduction rates may therefore fluctuate sharply from year to year, and any attempt to forecast the future movement of population on their basis is bound to be risky. A great deal of the recent increase in births in Britain, for instance, may be explained on the hypothesis that many births were 'postponed' during the early years of the war, and that these were later 'made up'.

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[1] Cf., e.g., E. Charles, *op. cit.*, and F. W. Notestein *et al.*: *The Future Population of Europe and the Soviet Union, 1940–1970.* League of Nations, 1944.

[2] J. Hajnal: "The Analysis of Birth Statistics in the Light of the Recent International Recovery in the Birth Rate", *Population Studies*, Vol. 1, No. 2, 1947.

It seems plausible that completed family size, i.e., the average number of children per married couple at the end of the reproductive period of the partners, will provide a better index of population movements in the past and a firmer basis for forecasts in the future. In their Report[1] the Royal Commission reject the net reproduction rate approach quite specifically and study movements in average family size instead. But as this information can only be obtained with great difficulty from present official statistics, and even then only for couples marrying in or after 1938, a special sample Family Census was taken in 1946 to provide the Royal Commission with the necessary material. The full report on this Census will appear later as a separate publication.

The provisional Family Census results quoted in the Royal Commission's Report illustrate the decline in family size for couples married at varying periods before 1925 and whose fertility may be regarded as complete in 1946 when the Census was taken. It had always been realised that such a decline must have taken place, and the figures reinforce the conclusion that it has been steady and continuous since mid-Victorian days.

Now in order to yield fruitful results the new approach should make it possible to form a judgment about the probable future course of population trends. But any attempt to form such a judgment raises a number of new difficulties. The majority of women marry in their 'twenties and may continue to bear children for some 20 to 25 years after their marriage. It is therefore only possible to calculate the completed fertility of marriages which have taken place more than 20 years ago.

To overcome this difficulty data have been obtained from the Family Census which make it possible to follow a cohort of marriages of a particular year and to observe the number of children these marriages have produced at any particular duration. It is thus possible to take a cross section and to compare the reproductive achievements of different cohorts of marriages at equivalent durations.

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[1] p. 62, para. 153.

An extract from the Royal Commission's figures[1] is given below and shows the position of different cohorts at equivalent duration in 1938 and 1948.

Duration of Marriage	*Average Family Size in* 1938	1948
5 years	1.16	1.20
10 years	1.71	1.70
15 years	2.15	1.96
20 years	2.51	2.12

Bearing in mind the fact that about 80 per cent. of children are nowadays born within the first 10 years of marriage, it appears from these figures that the reproductive achievements of cohorts married in 1928/33 and 1938/43 are not very different. The Royal Commission are impressed by this and other signs of stability after a decline lasting for over 60 years, and conclude from these data that there are signs of stabilisation in family size.

Does this stabilisation mean that the population is now replacing itself? Before this question can be answered, certain assumptions must be made about nuptiality. The Royal Commission have calculated that if marriage rates of the unmarried remain roughly at the level of 1942–7,[2] and the family size is stabilised at about 2.2 children per married couple, there will be some deficiency in replacement, and they estimate this deficiency to be of the order of 6 per cent. per generation.

The Royal Commission do not lay down any general rule for measuring population replacement. The question is impossible to answer without a precise definition of the meaning of the term "current rates". The main appeal of the net reproduction rate was that it purported to give an unequivocal answer to this question, but we have shown above that this answer is not always realistic. A good deal of research will be necessary to determine what indices of marriage and fertility are stable through time, and can therefore be used for extrapolation and projection into the future. There can in fact be no mechanical statistical method by which this problem can be solved, and any analysis of replacement will demand a good deal of personal judgment.

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[1] Table xxviii, p. 52.

[2] There are certain technical difficulties connected with the measurement of marriage habits. For a discussion of these cf. J. Hajnal: "Aspects of Recent Trends of Marriage in England and Wales", *Population Studies*, Vol. I, No. 1, 1947. Reference should also be made to the technical appendix to the Royal Commission's Report, "The Measurement of Reproductivity", by W. A. B. Hopkin.

It is, therefore, perhaps unfortunate that the figure of a 6 per cent. deficiency which the Royal Commission put forward as their estimate of replacement has received a great deal of publicity. The reasoning by which this figure was arrived at is complex and not all the statistical evidence on which it was based has yet been published. The Commission put this figure forward as the most likely estimate, but they emphasise that there is a range of uncertainty about it.[1] It could also be argued that the Commission have read too much into the stability of the last 10 years, and that the future may see a resumption of the sharp downward trend in family size. A full and detailed assessment of the Royal Commission's conclusion will have to wait, until the full statistics are published. The present is, of course, an unpropitious time to make a forecast, for the disturbances to demographic rates caused by the war are only just dying down. A clearer picture of the situation should emerge in 2 or 3 years' time.

Dissatisfaction with the net reproduction rate has, of course, been felt by a number of demographers for some time past. It is, however, the great merit of the Royal Commission's Report to be one of the first official documents in which a new approach to the problem is tried out. As such it cannot fail to have a profound influence on future research.

The adoption of the new approach logically leads to certain recommendations regarding the collection and analysis of vital statistics in this country. The Commission recommend that fertility or Family Censuses should be taken regularly[2] and that the statistical divisions of the General Register Offices should be strengthened.

2. The Outlook for the Future

From the analysis outlined in the previous section the Royal Commission estimate the future movement of the population. Their calculations show that the alarmist projections of the 'thirties, one of which forecast a decline to about 4,000,000 by 2037 are unlikely to be fulfilled. It is in any case not very realistic to project population movements for more than about 20 or 30 years ahead; beyond that point the fertility assumptions which are always the most speculative part of a projection play an increasingly important part in determining the future population. Although in the Royal Commission's Report the projections are continued to the year 2047 it is on the prospects of the next 30 years or so that interest will be centred. The Royal Commission publish three projections: a low one, assuming that family size will fall to 80 per cent. of that of couples married 1927–38; a medium one assuming that family size will remain constant; and a high one assuming an increase of 6 per cent. in family size. It is assumed that mortality will continue to fall and that marriage rates will remain roughly constant at the level of 1942–7. On these assumptions the population of Great Britain which was 48.2 m. in 1947 will lie between 48.6 and 51.8 m. in 1977. Persons aged 65 and over will increase from 5 m. to about 8.2 m. and will constitute roughly one-sixth of the population as against one-tenth in 1947.

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[1] Report, para. 157–158, p. 63.

[2] Prior to the special Family Census of 1946, questions relating to marital fertility were only asked on one occasion, at the general census of 1911. The data collected then were rudimentary and subject to difficulties in interpretation. Fertility questions have been included in the Censuses of many other countries for some time past, though in the 1946 British Census the questions asked were more detailed than in any previous Fertility Census.

Reasonable variations in the marriage and mortality assumptions will not affect these estimates appreciably and it may be regarded as highly probable that the population of Britain will continue to increase slightly in the immediate future, even if the slight deficiency in replacement continues.

The discussion of the statistical problems in the Royal Commission's Report is impressive and contains much that is new. It is the first official document in this or any other country which makes use of the cohort analysis in terms of average family size. Whilst it would be premature to say that the Royal Commission's analysis is completely correct in all its details, there is no doubt that it represents a considerable advance over previous treatments of the subject. The P.E.P. group could not, of course, draw on the same amount of statistical knowledge as could the Royal Commission but its conclusions are not very different, though not so well documented.

Once we leave the realm of statistical facts and embark on a discussion of population policy and of the economic and social effects of population decline, the argument becomes very much less precise. Indeed, the Royal Commission's treatment of those subjects is on a distinctly lower level than their discussion of the statistics. They examine problems of food supply, balance of payment difficulties and the effects of the changing age structure, but they are vague on the question of the optimum size of the population under present circumstances. In their discussion of the balance of payments they state (para. 344): there is . . ." good reason to be thankful that no further large scale increases in the population are probable ". A few paragraphs later (para. 362) the following sentence appears : " There is much to be said for the view that a failure of a society to reproduce itself indicates something wrong in its attitude to life, which is likely to involve other signs of decadence ". The Commission therefore " have no hesitation in concluding that a replacement size of family is desirable at the present time ". This, too, is the conclusion of P.E.P. though not for exactly the same reasons.

In the Royal Commission's view the economic arguments are not conclusive by themselves. Indeed, they stress the dangers of using a " narrowly utilitarian calculus to determine issues of population policy " (para 361) and state that " the least ponderable of them [consequences of population change] may be amongst the most important ". In coming to their conclusion they are influenced by strategic considerations, and by the intangible feeling summed up in the sentence quoted above that a failure to reproduce is a sign of decadence.

The P.E.P. group pay rather less attention to these imponderable factors, but are inclined to stress the unfavourable economic consequences that would be associated with a declining population. But in neither report is an attempt made to try and assess in quantitative terms the effect of variations in population size on the balance of payments, the level of employment, or economic activity in general. Calculations of this type would, of course, not be easy but they would be more interesting than the purely general discussion that the problem receives, even in spite of the large element of speculation that would necessarily enter into them.

In this connection, there are two problems the treatment of which in the Royal Commission's Report is disappointing :

the problem of the age balance and that of migration. On the former subject the Royal Commission state:

> " There is also, as we have seen, a conflict between the need for the productive effort of older people and the natural outcome of our present pensions arrangements and this constitutes a serious and most difficult problem. *We think that it would be straining our terms of reference to make any recommendations as to how this problem should be solved.* (My italics.) [Para. 303.]

It is difficult to agree with the last sentence. The changing age structure of the population is one of the consequences of present trends, and the Royal Commission are surely entitled to make recommendations thereon. The facts and probable consequences of the impending change are clearly set out and it is hinted in several places that present policies will lead to an unduly heavy burden of dependency due to old age, but the Royal Commission nowhere make any specific recommendations on the subject. It is difficult to avoid the conclusion that this reluctance to comment was due to a desire to avoid the admittedly difficult problems inherent in any discussion of this question.[1]

As far as migration is concerned, the Royal Commission accept the fact that even at the present rate of emigration Britain could not hope to supply more than about one-third of the migrants needed to maintain an annual rate of growth of 2 per cent. in the countries of the Commonwealth. The Commission say little that is new on problems connected with emigration: but their attitude to immigration is comparatively illiberal. They point out that an annual net inward migration of 140,000 young adults would be necessary to prevent a decline in the number of the younger age groups. They stress the difficulties of finding suitable immigrants, the expenditure that their settlement would entail, and the difficulties of assimilation. They conclude that " continuous large-scale immigration would probably be impracticable and would certainly be undesirable and the possibility . . . that circumstances might compel us to consider or attempt it is among the undesirable consequences of the maintenance of family size below replacement level " (para. 330). The P.E.P. report, on the other hand, makes the point that selective migration makes it possible to overcome shortages of labour in certain sectors of the economy, and that " immigration on a smaller scale would serve a useful purpose in correcting an unbalanced sex and age structure " (p. 112). It considers possible sources of immigrants and makes recommendations on a positive immigration policy. Whilst the authors of this report would probably agree with the Royal Commission on the subject of " continuous large-scale immigration ", the whole tenor of their chapters is more liberal than the statements of the Royal Commission. It is a pity that the Commissioners did not call for evidence on the effects—social, political and economic—of the small scale immigration into Britain before and after the war.

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[1] Cf. also Mr. R. F. Harrod's criticisms of the Royal Commission on this point in the *Cambridge Journal*, III. 1 (October, 1949).

3. The Problem of Population Policy

As both the Royal Commission and P.E.P. were agreed on the desirability of keeping the population at replacement level, the next step in their deliberations was the formulation of proposals which would have this desired effect. Unfortunately the treatment of these proposals, too, is rather disappointing in both reports. This is partly due to difficulties inherent in the subject : it is not easy to determine with any degree of accuracy the consequences of particular policy measures on population movements, and the experiences of other countries in this field are not a reliable guide to conditions in Great Britain. In the case of the Royal Commission, however, there is the additional difficulty that the Commission have not formulated the bases of their policy proposals in sufficiently precise terms.

This is not to say that no basic principles are laid down. The Commission state in para. 427 :

> " Control by men and women over the numbers of their children is one of the first conditions of their own and the community's welfare, and in our view mechanical and chemical methods of contraception have to be accepted as part of the modern means, however imperfect, by which it can be exercised ".

And again in para. 430 :

> " . . . in considering what should be done to adjust social policy so as to promote family welfare we rule out

> any measures that would tend to impede the spread of voluntary parenthood or to restrict the freedom of women. Indeed we take the view that it is in the long run interests of the family that voluntary parenthood should become universal and that women should have the maximum freedom in the ordering of their lives."

Similar principles are accepted by the P.E.P. group, and in this matter neither body can be accused of equivocation. These two basic principles are stated firmly and clearly, and though they are by no means uncontroversial, it is likely that a large part of the public will agree with them. The Royal Commission should be given credit for their courage in stating these two principles, which are rather in advance of those observed by other official organisations. The Commission recommend that the giving of advice on contraception to married persons who want it should be accepted as part of the duty of the National Health Service.

However, it is in the detailed application of measures of social policy that the main weakness of the Royal Commission's Report lies. The Commission state in para. 406 their

> " general conclusion . . . that social development over the past 70 or 80 years has tended to accentuate the relative . . . handicaps of parenthood, and that . . . these handicaps . . . are still substantial ".

In para. 419 they continue:

> " Measures to correct this fault [handicap of people with children] would make for a fairer and more healthy society, and are therefore justified on grounds of social welfare alone. *They are justified also on population grounds, since the handicaps of parenthood have played a large part in the fall of average family size below replacement level.*" (My italics.)

It is not quite clear on what evidence the last sentence is based and, though it may well be true, too much should not be read into it. It would not, for instance, be justifiable to deduce that a removal of the social and economic handicaps, however desirable on the grounds of social justice and equity, would lead to a rise of average family size to replacement level, and the conclusion which one comes to on reading the Royal Commission's report is that practically all their recommendations are based on the desire to reduce the inequalities between families with and those without children, on grounds of social justice. This is, of course, a perfectly defensible point of view, but whilst one may agree with the Commissioners that the removal of inequalities of this kind would make for a " fairer society ", it has not been demonstrated that these measures can be justified on population grounds.

The Commission's proposals for abolishing the inequalities may be divided into two groups: financial proposals and other proposals. On the financial side their proposals are summed up in para. 492 as follows:

(i) that the rates of free allowance under the Family Allowances Act should be increased forthwith to 7/– a week and for children of 11 years or over to 10/– a week, subject to the exclusion of the youngest child of the family.

(ii) that when financial conditions permit, the limitation which excludes one child in each family from the scope of the allowances should be removed.

(iii) that so long as the exclusion of one child is retained a moderate lump sum payment for the first birth should be made instead.

(iv) that the allowances should be payable in advance of birth when pregnancy is established.

(v) that professional contributory schemes for supplementary children's allowances should be encouraged.

(vi) that the principle of children's allowances should be reintroduced into the salary scales of officers of the fighting services.

(vii) that in computing the income chargeable to income-tax the deduction made from the income in respect of each dependent child should be either £60 (as a minimum); or one-tenth of the earned income up to £1,000 plus one-twentieth of any earned income in excess of £1,000, subject to a maximum deduction of £150.[1]

(viii) that the cash allowances paid under the Family Allowances Act should be exempt from income tax.

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[1] It may perhaps be mentioned that in the first printing the summary in para. 658 differs from the recommendations in para. 492. This error has been corrected in the reprint.

It is difficult to argue about proposals of this nature. The principle of redistributing incomes in favour of families with children has been accepted in Great Britain for some time, and family allowances are undoubtedly one of the most efficient ways of ensuring that the benefits reach those for whom they are primarily intended. It has indeed been argued that a reduction in the food subsidies, with a consequent increase in family allowances, would lead to a redistribution of income which is more efficient in reducing inequalities than are the present subsidies by themselves. As the financial situation has further deteriorated since the appearance of the Royal Commission's Report, it is unlikely that any increase in family allowances will come about unless other forms of the social services are reduced simultaneously.

It seems doubtful, however, whether recommendation (ii) of the report is really justified under any circumstances. The Commission state that " the proportion of married couples who remain deliberately childless is far smaller than the proportion who restrict their families to a single child " (para. 451). They also state that " the great majority of parents can afford to maintain a single child without financial assistance, and that the philoprogenitive impulse should be strong enough to induce them to shoulder readily the economic sacrifice which this involves ". In view of these statements the *volte-face* of the second recommendation is surprising. The reasons given for it are unconvincing. It is stated that . . . " it is usually the coming of the first child that makes the most significant addition to a married couple's expenditure and the most radical change in their way of life ". It is true that the coming of a first child involves a couple in a good deal of capital expenditure, but the running cost of a single baby in the first two years of its life is very small, particularly if advantage is taken of the social services in kind that are provided for it. The difficulties of meeting capital expenditure are better met by the recommendation under (iii).

The proposals under sub-heads (v) to (viii) may be criticised for a different reason altogether. Their effect would be in most cases to yield a higher benefit to those in the higher income groups. Thus the Commission propose to reintroduce family allowances into the remuneration of officers of the fighting services, but make no recommendation about allowances for other ranks. The recommendations concerned with income tax reliefs and the freeing of family allowances from tax are designed primarily to benefit parents with higher incomes. Though there will be no disagreement with the Royal Commission's statement that "those with high and medium incomes represent an important element in the community, whose ways of life, standards of value, and ideas influence their fellow-citizens both directly and indirectly", it is questionable whether it is socially just for higher relief to be given to parents with higher incomes. The Royal Commission's case that present income-tax reliefs for families with children are inadequate, is a strong one. It would seem, however, that the best and easiest remedy would be to increase the amount of income on which relief is given. If it is desired to give greater relief to families with many children, the flat rate of relief might be increased for children of higher parities. Thus, a family with one child might obtain a relief on £50 of their income, one with two children on £125 and so on.

The Commission in effect recognise that the expenditure on children varies with the parents' income, and their proposal is designed to make it easier for parents to meet expenses which are conventionally incurred at a particular level of income. With the extension of services in kind, which are to-day available for children, the proposal for giving higher reliefs to persons with higher incomes seems undesirable and constitutes an entirely new principle. It is difficult to believe that at the income levels at which the proposed new concession would operate, the income available is insufficient for the physical needs of parents and children and it does not seem to me desirable to allow for the conventional needs of families with many children in the way which is proposed. Nor is there much reason for believing that such measures would necessarily increase the birthrate among higher income groups. A flat-rate increase, which would give greater proportionate relief to families with medium incomes would seem a much better method of giving additional relief.[1]

An argument which is sometimes heard in favour of proportionate allowances is based on differences in fertility which exist between the lower and the higher income groups.

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[1] Cf. also H. S. Booker: "Income Tax and Family Allowances in Britain", *Population Studies*, Vol. III, No. 3, December, 1949, for a discussion of the effect of changes in income-tax allowances on families with different numbers of children.

It is maintained that bigger allowances for the higher income groups would reduce the gap and would be eugenically beneficial. As has been pointed out already, the effect of increasing cash benefits cannot be forecast with any degree of accuracy, and the identification of higher income with eugenic or social value which, in one form or another, is at the bottom of this type of analysis is based on rather doubtful evidence.

It should be mentioned that the P.E.P. group also put forward a proposal which is similar to recommendation (vii) of the Royal Commission. Their proposal is brought forward with much more hesitation than that of the Royal Commission, and the group is rather doubtful about its political feasibility.

The financial proposals in the Royal Commission's Report are explicit and an attempt is made to work out the additional burdens that will be placed on the Exchequer, if they are to be brought into operation. The picture is very different when we consider these sections of the Report which deal with other services designed to help families. One would expect that the Royal Commission would have described what services are available, analysed the way in which they were working, discussed the demands that they make on the nation's manpower and assessed the contribution that they make to family welfare. The Royal Commission could then have given their considered opinion on the future development and administration of these services and have indicated a scale of priorities for extension and development. Nothing of the kind is done in the report. There is a very brief description of the home-help service, of day-nurseries and nursery schools, and of residential nurseries. No attempt is made to describe in detail how these services work or to show their costs in terms of money or manpower, nor is there a discussion of the relative urgency of the needs that they are designed to satisfy. The Commission give a vague blessing to all these schemes because they help in alleviating the lot of those with children, but their only precise recommendation is that parents should pay in accordance with their means for such services as home-helps or nurseries, and that no public provision should be made at present for households with an only child who is under two. There are also a couple of paragraphs in which the Royal Commission state that they are in favour of better-designed washhouses, and of the provision of holiday rest-camps for mothers. The housing problem, too, gets rather scanty treatment, the only recommendation of importance being that a Departmental Committee should be set up to discuss the feasibility of introducing a universal scheme of rent rebates related to the number of children in the household.

When the care which the Commission have given to the discussion of the statistical evidence and the comparative precision of their financial proposals is compared with the vagueness of their treatment of social policy and services in kind one is left with a feeling of disappointment. Evidence on the actual way in which social services work is hard to come by, and one would have expected a Royal Commission which has resources and powers not available to the private investigator to have devoted more attention to these important topics and to have expressed an opinion on the way in which they should be developed. There is need for research into the actual working of schemes designed to assist the family. Such investigations are now beginning to be undertaken,[1] and have led in some cases to remarkable results. It is quite possible that the money and manpower which are at present expended on these social services could be more efficiently laid out or that the same results could be achieved for less expenditure, but the Royal Commission do not consider the problem from this point of view at all. It would indeed appear that very little thought has been given to these problems, for among the Commission's papers which are to be published in the future there is no mention of any work being done on social services.

It must be admitted that the P.E.P. group's treatment of this subject is also inadequate. In their report also there is no detailed treatment of the costs of and needs for services to the family in kind.

4. Conclusions

The reports of the Royal Commission and of P.E.P. are the first major works on demographic subjects published in Great Britain since the war. It is evident that the analysis of demographic data has progressed much since the pre-war period, and the Report of the Royal Commission in particular makes a contribution to the method of demographic analysis which is of great importance. The Commissioners themselves will not want to claim finality for their methods or results, but a great step forward has been taken. One will have to wait for the publications of the Commission's technical papers before being able fully to assess the utility of their method.

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[1] Cf. for instance *Maternity in Great Britain :* A Survey of Social and Economic Aspects of Pregnancy and Childbirth, undertaken by a Joint Committee of the Royal College of Obstetricians and Gynæcologists and the Population Investigation Committee, London, 1948, and J. W. B. Douglas and G. Rowntree, "Supplementary Maternal and Child Health Services," *Population Studies*, Vol. III, No. 2, 1949.

In the other fields, however, little progress has been made. There has still not been any detailed empirical treatment of the influence of population size on economic magnitudes; a proper study of the demographic components in the demand for housing, for instance, remains to be undertaken. On the side of social policy an investigation into the efficiency of services designed to aid the family has yet to be carried out, and study of the extent to which these policies help in raising fertility is necessary. It is in these fields that both the reports under consideration are disappointing, and that a good deal of research remains to be done.

The London School of Economics.

Book Reviews

The Theory of International Values. By FRANK D. GRAHAM. Princeton University Press. 1948. viii + 345 pp. $5.00.

Professor Graham's book is ostensibly a criticism of classical theory, but the attack is directed chiefly against J. S. Mill and later writers in the classical tradition, such as Bastable, Marshall, Taussig. Graham expresses appreciation of Ohlin's work, but in certain fundamentals his position leans more to the pre-Mill classical approach than to that of the moderns. Whilst others have credited Mill with pointing out the way of escape from the limitations of Ricardian theory, Graham contends that Mill was wholly mistaken in the way in which he attempted to make good Ricardo's deficiencies.

The main point attacked is the view that cost conditions give the terms of international exchange only within limits, and that the precise terms are set by the play of reciprocal national demands. Graham maintains that normal values (as opposed to market values) in international trade, as well as in domestic trade, can be explained in terms of cost, with demand playing only an indirect and subordinate part. The ' volatile ' character of demand is frequently stressed as rendering it unworthy to play an important part in determining normal values, and the idea of reciprocal national demands, Country E bartering its distinctive products for those of Country G, is derided as wholly unrealistic. The rejection of the neo-classical approach carries with it the rejection of a number of corollaries.

The key to Graham's own position is the recognition that in the typical case a country does not specialise in one international good, and that equally a particular international good is not usually produced in only one country. There is in fact a considerable overlap of products between countries, or rather a series of overlaps ; and since relative costs govern normal price relations within each country, there is a nexus through cost relations between the prices of goods produced in different countries. Thus, to take the simplest example, if Country A produces commodities x and y, their values are tied together by relative costs in A : if B produces y and z, their values are similarly connected ; and hence the relative value of x and z is fixed.

In the first seven chapters Graham develops his theory with elaborate examples, based on the assumptions of constant costs and costless transport. Here he shows himself a master of the higher arithmetic, outplaying the classics at their own game. The examples are worked up into tables which seek to show how specialisation and trade will be arranged and the scale of international values determined so as to satisfy the essential conditions : that supply shall equal demand,

and that each country shall confine its production to lines in which, at the current ratio of international exchange, it has a comparative advantage or at least is not at a comparative disadvantage. Assuming differences in the economic size of the countries (not balanced by differences in the volume of demand for their specialities), a solution can only be found if several of the countries have each several products (produced at relative costs corresponding with the international price ratio) and countries sometimes import a commodity which they also produce (even with constant costs). The reaction of demands to the changes in relative values brought about by international trade is taken care of by the alternative assumptions that the different kinds of goods are consumed in constant proportions in each country, or that a constant proportion of each country's resources is devoted to obtaining each product, directly or indirectly: Graham seems to admit that this is not an ideal way of dealing with the matter, but holds that it is good enough for his purpose. The nature of the solution is far from obvious at first when one is presented with the tabulated data, and Graham works his way to it by a process of trial and error—aided perhaps by some special instinct. It is suggested that in reality movement to the equilibrium position is aided by temporary divergencies of market values from normal values. It appears to be implied that there is usually only one solution.

Having found the solution for given conditions along these lines, Graham then proceeds to study the possible effects of changes in demand. It is shown that within his scheme shifts in demand can be met to a great extent by changes in the allocations of resources in the various countries. In particular the examples are used to show that considerable changes in demand can be met without any change at all in the scale of international values: that when the latter does change, the extent of variation may be quite small in relation to the shift in demands: and that from the re-shuffle it is quite possible for a country which in the first place experiences an uncompensated decline in the demand for one of its products to come out with a net gain. This last point is advanced as an important refutation of classic and neo-classic theory. So far as demand does affect the terms of international exchange, it is argued that this only happens to the extent that supply conditions are changed in the re-allocation of production.

The assumption of constant cost, which has been adhered to so far, is relaxed for the space of 5 pages in Chapter 8: thereafter the variation of costs with the scale of output receives little attention. Graham can of course claim that in dealing with the classical theory he is justified in using classical assumptions; but the defence is hardly available when he is dealing with neo-classics, and in any case the practical value of Graham's own contribution would be very small if it be limited to constant cost conditions. Clearly Graham does not think that this is the case. In the interlude referred to, it is correctly contended that rising cost conditions must tend to cause greater diversity of national output and hence a greater range of production carried on at cost ratios in agreement with international price ratios. But surely it also means a drastic restriction in the scope for the juggling with production allocations in the various countries of the kind which made it possible in Graham's examples to make considerable changes in the relative output of various commodities with little change in their relative values. Having shown so much industry in the preparation of his ' tableaux ' earlier, it is surprising that the author did not go further and work out cases on the assumption of variable costs.

But what is the meaning of *costs* in Graham's theory ? The resources expended are conceived to be general resources and not merely labour, and beyond that the costs are measured as " opportunity costs ". But opportunity costs are defined, so to speak, in real terms ; that is to say, the opportunity cost of producing a certain amount of one commodity is the alternative physical product which could be obtained from the same resources. Thus opportunity cost is independent of value, like classical labour cost, and this has made it possible to give the above summary of his position without discussing his differences from the classical theory of domestic values. This interpretation of Graham's use of ' opportunity cost ' seems justified by his statement (*passim*) that a country's specialisation depends on its opportunity cost ratios *and* the scale of international values. But there are places in which he speaks of the opportunity cost on the basis of this scale of values—opportunities for the use of the resources in production for foreign trade being taken into account as well as opportunities of direct production for the home market. This is indeed true opportunity cost. But interpreted in this way Graham's theory is not so different in form from that of the neo-classics ; for in their view also trade and specialisation are determined by the opportunity costs given by the possibilities of producing both for home and foreign markets. They differ in so far as they express the opportunity cost in value rather than in physical units. This is more realistic and makes it possible to tie in the domestic price structure which Graham only brings in at a later stage and in a rather disconnected way. Beyond this there is, of course, a difference of substance with respect to the influence of demand in determining opportunity costs.

There is a further difference between Graham and what I should call the modern rather than the neo-classic school. In Graham's theory the opportunity costs attach to the use of ' general resources ', no account being taken of the different combinations of factors which are used for different purposes. There are indeed references to the national differences in factor endowment in a few pages towards the end of the book, but they are not incorporated into the main theory. This seems to me to affect very materially the results reached. In Graham's theory, for two products to have equal (opportunity) costs means that they are produced by the same factors (or at any rate, the same 'cost factors'; when he allows that costs may not be constant, he must presumably be recognising the existence of 'rent factors'); whereas the fact should only mean that the requisite factors in the two cases have the same value in their respective, possibly quite different, alternative uses. If Graham's analysis is corrected in this respect, it follows, firstly, that demand, home and foreign, as the determinant of 'value in alternative uses' is less easily ignored; secondly, that the likelihood of increasing costs is greatly enhanced; and thirdly, that a change in demand which favours the kind of factor combination which a particular country is best able to provide can hardly fail to redound to that country's advantage.

Despite Graham, I still think, therefore, that J. S. Mill was putting theory on the right lines by increasing the emphasis on conditions of demand. One may agree, however, that there have been crudities in the application of the neo-classic theory through excessive reliance on the two product–two country model, and through disregard of the similarities which often exist between the products and even the factor endowment of the countries which have to be considered. It is in this connection that Graham makes his most effective points, particularly in the discussion of the reparation transfer problem.

Professor Graham conducts his argument brilliantly, and I think economists will enjoy reading the book whatever reservations they may have with regard to its conclusions.

Barrett Whale.

Demographic Yearbook, 1948. U.N. Publications Sales No. 1949. XIII. 1. 50s.

From 1927 to 1944 an annual compendium of world population statistics was available in a section of *The Statistical Year-Book of the League of Nations.* From 1944 until the appearance of the work here reviewed we have had to do without any such useful, indeed almost indispensable, source of reference. Now the gap has been filled by the Statistical Office of the United Nations in collaboration with the Department of Social Affairs. The *Demographic Yearbook* is entirely devoted to population statistics, as its title indicates; it has been excellently produced and is in all respects a credit to those responsible for it. An informative introduction of thirty-five pages precedes thirty-nine tables grouped under the following heads: population, births, deaths, marriages, reproduction rates, life tables, and migration; it also includes five maps and a bibliography. The volume runs to 596 pages and has been kept down to this length only by omitting many important topics such as population by race, citizenship, country of birth and language; births by sex, month, legitimacy, age of mother and parity; deaths by cause of death; maternal mortality; occupational diseases; divorces. It is intended to include the omitted topics through a system of rotation in successive issues of the *Yearbook*.

The first table gives a figure for the population of every country, and alone out of the thirty-nine tables covers total world population. It is possible to present the table because for countries where exact evidence is lacking an estimate of population, however dubious, has been secured from some source. The resulting world total is 2,326 millions for 1947 ; the last global figure given by the League of Nations was 2,170 millions for 1939. What degree of trust can be reposed in the figure of 2,326 millions ? According to the *Yearbook* about three-quarters of the world's population has been enumerated by census, and it might be thought that for this section of the total, amounting to 1,709 millions, we are on fairly firm ground. But an inspection of the second table, showing which countries are included in the three-quarters, is not re-assuring. Uganda, for instance, appears in this table though the census of Uganda available when the *Yearbook* was compiled took account only of the non-native population, which amounted to 45,000. Since the total for Uganda as given in the *Yearbook* is 4,063,000 it follows that, except for a small fraction of the population, this figure is a mere estimate. Moreover, we now know that it was a poor estimate ; for a well organised census of the whole population was taken in Uganda for 1948, too late for inclusion in the *Yearbook*, which revealed a population of nearly five millions. Again, the U.S.S.R. appears among the countries enumerated by census, a census figure of 170 millions being available for 1939, and in addition a single post-censal figure of 193 millions for 1946. The U.S.S.R. does not appear in the third table which gives, where available, a figure for each country for each year from 1932 to 1947 inclusive ; so it would seem that for this area, which may contain nearly a tenth of the world's population, the only recent figure can hardly inspire great confidence. Other examples of countries classed as enumerated by census could be given showing that for them we have no very trustworthy figures, whence it follows that the total of 1,709 millions for the 'enumerated' countries is not as firm as might appear at first sight.

There remains the quarter of the world's population which is allotted to countries which have not been enumerated. A number of countries contribute to this fraction of which one, namely China, is of dominating importance. The League of Nations was content to put down 450 millions for China year after year, but it was known that estimates made by persons who had studied the available data differed by as much as 100 millions. The third table contains no estimate for China until 1940, when a figure of 458 millions appears ; figures for the years following up to 1947 are presented which fluctuate between 450 and 463 millions. Given the fact that there is no census as a basis and remembering the state of the country at the time, it is not possible to take these figures seriously.

Our knowledge of the size of the population of the world is therefore less sure than is commonly supposed, and indeed less accurate than might be guessed from a glance at the formidable tables in the *Yearbook.* It is only fair, however, to say that there are plenty of warnings in the introductory pages that the figures should not be taken at their face value; these warnings are in general terms and no finger is pointed at the return from any particular country—the reader being left to make his own assessment of the value of the figures. This, no doubt, is inevitable in a publication under international auspices; it would hardly do to draw attention to the fact that the authorities in a country represented permanently on the Security Council do not know whether they are responsible for 400 or 500 million people. Since it is easier to establish a figure for the total population of a country than for any other topic of demography, it is not surprising to find that only sixteen of the thirty-nine tables in the *Yearbook* cover more than half the world's population; thus figures for birth-rates cover 58 per cent., for death-rates 57 per cent., for marriage-rates 36 per cent., for reproduction rates 22 per cent., for live births by birth order 21 per cent., and for emigrants by country of intended residence 12 per cent. Moreover, the figures which do exist relating to these topics are even less trustworthy than the figures for total population where enumeration is said to be practised. Thus the Indian figures for total population are generally regarded as fairly trustworthy, but no Indian authority places much confidence in Indian vital statistics. Migration figures which exist only for a few countries are in even worse case, and it is hard to reconcile emigration with immigration totals.

Responsibility for the defects in the figures does not lie with the authors of the *Yearbook*, who have performed a difficult task well; it lies with the governments of the laggard countries. The difficulties encountered during the compilation of the *Yearbook* can be illustrated by the following facts taken from the introduction. A list of some 250 areas was compiled—including sovereign countries, dependencies, trust territories, condominiums and international administrations—and a questionnaire was despatched to each of them by the end of June, 1948. By the end of March, 1949, replies had been received only from 166 which covered about 77 per cent. of the population of the world; no reply was received from the U.S.S.R. It may well be that the governments which did not reply had no trustworthy figures to communicate; but it is also the case that some countries, China for instance, which did answer, could only supply very dubious estimates even of total population. No doubt world population is increasing, but some of those who write about population trends, especially in relation to food supply, might well be a little less positive that they know just what is going on.

A. M. Carr-Saunders.

The Bank of Ireland, 1783–1946. By F. G. Hall. Hodges, Figgis & Co. Ltd., Dublin. B. H. Blackwell Ltd. 1949. x + 323 pp. £3 3s. 0d.

This is the official history of the Bank of Ireland, prepared under the editorship of Professor George O'Brien. Mr. Hall has had access to all the books and papers of the Bank, and to certain private papers of the Bank of England and H.M. Treasury. He has also used the published official documents (Parliamentary Committee papers, statutes, etc.) and the quite considerable pamphlet literature directly bearing on his subject. The published materials (particularly those relating to the depreciation problem in 1804) had previously been used piecemeal by English and other scholars, but the subject had not previously been treated as a whole nor had the Bank's archives been reviewed.

Mr. Hall has actually cast his net rather more widely than the title indicates. Besides the history of the Bank of Ireland itself, here is virtually a history of all Irish banking—the private banks and the other joint-stock banks as well as the privileged analogue of the Bank of England. Information about negotiations for help or for outright purchase by the Bank of Ireland has enabled Mr. Hall to put together clear and fascinating accounts of the end of the Munster Bank, and of La Touche's, for example. The establishment and the teething troubles of the joint-stock banks after the 1821 qualification of the Bank of Ireland's monopoly provide interesting parallels with the early days of the English joint-stock banks.

Most interest lies, however, in the story of the Bank of Ireland itself. Though founded with an eye on the Bank of England and confronting many similar problems of organisation and policy, important points of difference between the two institutions emerge in this account. The Bank of England was founded primarily for government financial purposes and through its first fifty years government business was its main prop, but the Bank of Ireland was founded primarily to serve commerce. (It is curious to find that whereas the Bank of England's Committee of Treasury became the most important governing body because Treasury business was the most important business in the early days, the Irish institution apparently named its 'Treasury Committee' merely because that was the most important Committee.) Throughout its history, ordinary banking business bulked more largely for the Bank of Ireland. But its special position as a note-issuer was recognised in the Parliamentary enquiry into the 1802–04 inflation; and in the 1820 crisis the Bank was accepting responsibility for helping the private banks generally in time of crisis. On the other hand, the Bank of Ireland in its turn looked to the Bank of England for support of one kind and another; and the relations between the two are worthy of the attention of anyone interested in the early development of the Sterling Area. (Some important correspondence between Horsley Palmer and the Governor of the Bank of Ireland has been discussed by Mr. Horsefield in the latest (1949) issue of the *Economic History Review.*)

For fifty years, at least, the Bank of Ireland and the Bank of England have histories running closely parallel. Inflation in the Restriction Period, the limitation of the monopoly, the preference for discounting as contrasted with overdraft loans, the opening of branches and the difficulties of staffing them, the hostility of the other banks—on all these matters there is much in common in the two institutions in the first half of the nineteenth century. In dealing with these matters Mr. Hall has had the benefit of close contact with Mr. J. K. Horsefield, whose authority in the English banking history of this period is well known to readers of *Economica.* But I cannot help regretting that the Irish work was not undertaken by someone directly familiar with the English history. Mr. Horsefield has been unable to save Mr. Hall from all error—particularly where it is a matter of shades of opinion. For example, on page 97 the author says, " the strongest supporter of the recommendations of both Committees [the 1804 Committee on the Irish Currency, and the Bullion Committee, 1810] was Henry Thornton " ; but Professor Fetter's close examination of Thornton's position (*Quarterly Journal of Economics*, August 1942, p. 662) shows that Thornton was very hesitant about the proposal to restore convertibility after two years, and only reluctantly supported it as the one practical way of securing attention to the more fundamental requirement of regulating issues by some principle less objectionable than the Bank's crude ' needs of trade ' theory.

The considerable space given to the English side of the picture—a side with which it would be unreasonable to expect all readers of this book to be familiar—helps to make the book a very long one. But there are some other causes of length which have not such good excuse. Lengthy documents are often reproduced in full in the main text, when relegation to appendices or drastic pruning would have been more appropriate (the National Land Bank documents on pp. 342 *et seq.* are an extreme case of this). The Banking Commission Report of 1938 curiously enough gets a single page of brief review. The style of this book is pedestrian. But I do not want to be ungracious. Mr. Hall has shown that even those who walk can get a very long way, and the book is a substantial contribution to banking history generally and to Irish economic history.

The Bank of Ireland has seen to it that the volume is handsomely produced. Besides Mr. Hall's work the volume includes an architectural chapter by Mr. C. P. Curran ; the fine photographs of the Head Office at College Green, Dublin, strike a layman as worthy of the admirable subject. Finally there are Biographical Notes of the Directors of the Bank, compiled by Mr. Joseph Hone. I found a good deal of interest in these contributions, but I can claim no competence to judge their adequacy.

R. S. Sayers.

Economic Survey. By W. Arthur Lewis. Allen & Unwin. 1949. 221 pp. 15s.

Professor Lewis' outline of the economic history of the world during the inter-war period fills a very important gap in the reading-list of the undergraduate student of economics. His book is in three parts. The first gives a brief general sketch of the history of the period in three phases: Reconstruction (1918–25); Prosperity (1925–29); and the Great Depression (1929–39). The second part deals in more detail with certain major developments in each of six countries—the United Kingdom, Germany, France, U.S.A., Japan and Russia; and the third attempts the difficult task of setting the whole period in its proper perspective against the history of the last hundred years.

Within its limits, the task Professor Lewis has set himself is admirably done. His selection of important things out of the great mass of available data is judicious, and his judgments on the many controversial issues considered are in general extremely well balanced. There are, however, instances where the inevitable compression of his analysis has led him into over-simplification and sometimes to too sweeping conclusions. Thus, in his discussion of how a depression originating in one country can be prevented from infecting the rest he seems to assume a world in which the marginal propensity to import is everywhere very low—even in primary producing countries (p. 165)—and where a fall in national income seems to have no tendency (except perhaps in Japan) to promote exports. Thus he sees no difficulty in rejecting any measure of disinflation as a means of facilitating the adjustment of an adverse balance of payments—apparently in any circumstances. On the other hand, in his world all countries seem to have a fairly high price elasticity of demand for imports, so that either a tariff or devaluation can provide a simple and largely painless remedy for any adverse balance. As we are discovering at the moment, the problem is a good deal more complicated than this.

Again, in his approbation of buffer stocks as a means of evening-out fluctuations in demand (p. 174), he does not make it clear whether he is in favour of stabilising prices of individual commodities or merely of the collective price of a large group. Attempts to stabilise individual prices are likely to involve a useless waste of resources in attempting to offset permanent changes in the direction of demand; the stabilisation of group prices on the other hand seems to offer a promising line of approach to the stabilisation of the purchasing power of money.

A point on which his reasoning rather than his conclusions may be questioned arises in the course of his search for the causes of trade depressions, and for the main cause of the 1929–33 depression in particular. The explanation to which he attaches most weight is that periods of trade activity are those when supplies of primary products are scarce relatively to manufactures, while depressions occur when primary products are in relative over-supply. If this is so (and Professor Lewis makes a good case for it) it is surely due, not so much to the difference in elasticity of supply between primary products and manufactures (p. 196), as to the fact that the main manufacturing countries are also the main financial centres. When, therefore, prices of primary products rise relatively to those of manufactures and manufacturing countries tend to have adverse balances of payments with primary producing countries, the foreign exchange reserves of the latter rise and, a little later, their imports. When, on the other hand, prices of primary products are relatively low and it is the manufacturing countries that have the favourable balances, the foreign exchange reserves of the primary producing countries are depleted, their imports fall, and there is unemployment in the manufacturing countries.

Professor Lewis illustrates his descriptions with a wide range of most useful statistics, some of which are published in the text and a few in the statistical appendix. It would add greatly to the value of this book if, in the next edition, this appendix were considerably extended by the publication in full of more of the tables of which extracts are given in the text. It is true that Professor Lewis is careful to give his sources, but these are not always accessible to the ordinary reader. At the same time there is at least one series that should be replaced—that for Industrial Production in the United Kingdom since 1913. For this Professor Lewis at present uses Hoffman's index, though he admits (p. 80) that it underestimates the post-war growth by some 20 per cent. Yet in several other places he quotes it without reservation and thus gives a quite misleading impression of the progress of the British economy. By using Professor Bowley's estimate for the change in physical production between 1907 and 1925 and the inter-war London and Cambridge Index of Production, a much more realistic index can be constructed without great difficulty. It is also surprising that he does not mention the reduction between 1913 and 1921 of about 10 per cent. in the length of the normal British working week, to which the slightness of the rise in even the corrected index between 1913 and 1925 is mainly due.

These criticisms are, however, small in comparison with merits of the book as a whole. It can be recommended unreservedly to undergraduates, and many more senior students will also find it an indispensable addition to their libraries.

F. W. PAISH.

Alternative to Serfdom. By JOHN MAURICE CLARK. Basil Blackwell, Oxford. 1948. 153 pp. 8s. 6d.

In case the title of the book misleads the prospective reader, it should be stated at the outset that this reprint of a series of lectures delivered at the University of Michigan in March 1947 is not concerned directly with the issues raised in Professor Hayek's famous book. Professor Clark does not consider the merits or demerits of particular political systems. " On the whole it seems truer to say that there is only one possible system : the system of using the agencies that exist and trying to make them work together " (p. 123). With this in mind, Professor Clark proceeds to examine existing American institutions. While he, too, speaks with the voice of the social philosopher, he regards this duty as a natural extension of the functions of the economist which requires no apology (p. 9). Whereas Professor Hayek assumes that what men ultimately desire is a responsible freedom even if they are ' persuaded ' to believe the contrary, Professor Clark makes no assumptions about human aspiration. " We need to define the natural rights of man in a new setting, and with a new content. The idea of natural rights has been discredited, largely because it was associated with a set of specific rules embodying an obsolescent form and degree of individualism attaching to it an unwarranted claim to permanence, and applying formal contractual equality to a society whose differentiated functions no longer fitted this framework. But underlying this is the conception of the nature of man—his needs, reactions and capacities—and of the arrangements he needs in order to fulfil his individual nature and to do his job in society " (p. 19). The inspiration is Thomas Hobbes, not de Tocqueville ; we begin therefore with an examination of the ' generall inclination of mankind ' and accept no aprioristic conception of man as he ought to be.

The resemblance to Hobbes's description of pre-political society in the *Leviathan* and *Elements of Law* is by no means superficial. His examination of the evidence of biological and sociological investigation leads him to conclude that man desires, above all things, security—freedom from his own warring impulses which are too rarely restrained by voluntary social action. (Much of this part of the analysis is a development of Professor Clark's articles in the *Journal of Political Economy*, 1918.) Within the economic sphere, this demand appears to be actualised in the formation of ' protective agencies ' often of a monopolistic character which save the individual employer or worker from the rigours of competition. Now, according to Clark, the main danger of this procedure does not lie mainly in the economic consequences. Whatever formal theory may suggest about the restrictionism practised by monopolies, it exaggerates the extent to which this involves maintaining prices in order to maximise profits (pp. 64–8). No. The danger of group organisations of a monopolistic character, whether of capital or labour, lies in their powers of coercion and conflict of interest. This is Hobbes's " warre, as is of every every man, against every man " applied not to the individual, but to the group. Moreover, while Hobbes believed that the only solution lay in a Social Contract by which individual freedom was sacrificed for security, Clark argues that " the organising of these warring groups must be done by the more deliberate kind of action associated with the theory of the 'social contract'. In fact we seem to be in a stage of human development to which some form of 'social contract' theory may, for the first time, be applicable on the scale of a 'great society'" (p. 6).

Clark implicitly realises the weakness of Hobbes's solution of setting up "a Common Power to keep them in awe and to direct their actions to the Common benefit" (*Leviathan*: Part 2, Chapter 17) for "there must be a common bond, if only the danger of mutual annihilation, to furnish a basis for the willingness to recognise mutual rights and responsibilities" (p. 6). But Clark's own alternative to the Hobbesian solution amounts to little more than stressing the necessity for employers' organisations and trade unions to understand each other's point of view watched carefully by an anxious government whose "only legitimate aim is to curb power short of supremacy and to increase the forces that make for reasonable adjustment". What is more, it has to be admitted by him that "government cannot, by edict, replace resentment with harmony" (p. 147).

It is certainly instructive to follow Professor Clark's analysis of the pressures set up in the economic system as a result of the implementing of Keynesian remedies for unemployment and reductions in aggregate demand. He does make a courageous attempt to solve the problem of conflict between strong groups inimical to economic well-being and ultimately to stable government while recognising the necessity of retaining them as the important decision-making units in the economic system. But while it is always timely to remind us that with the acquisition of new rights, particularly those guaranteed by the state, new duties, often difficult to visualise, go with them, Professor Clark shrinks from any discussion of the appropriate political milieu in which the process of mutual understanding is to be developed. It is obvious that he has some difficulty in steering a course between the 'dangers' of the corporatist and competitive 'solutions', and while one may agree with Professor Clark that the speed of advance towards solving the tremendous problems presented by group organisation must necessarily be slow, one can never be sure of the ultimate direction that he has in mind. Hobbes faced the same difficulty with trepidation —"for in a way beset with those that contend on the one hand for too great Liberty, and on the other side for too much Authority, 'tis hard to passe between the points of both unwounded" (*Leviathan*: Introduction).

ALAN T. PEACOCK.

Esquisse d'une Théorie Générale de l'Equilibre Economique. By CLAUDE GRUSON. Collection "Theoria". Presses Universitaires de France. Paris. 1949. 328 pp. Fr. 600.

The subtitle to M. Gruson's book: "Réflexions sur la Théorie Générale de Lord Keynes" is the best description of its scope. Taking for granted that the most urgent problem of internal economic policy is the maintenance of a stable level of employment and of prices in a democratic framework, M. Gruson sets out to show that there exists no automatic mechanism capable of maintaining this "economic stability", and that monetary action on the level of interest rates, though necessary, can be only of dubious efficacy. More active measures of policy are required, but M. Gruson stops short of telling us how he conceives them. There is nothing very new in all this, and the reader of this review might well be tempted to bury the book in some remote corner of his library. And, as sometimes happens, the reader would be wrong; for M. Gruson's reflections on Keynes' theory are instructive in many respects.

The bulk of the book (pp. 1–254 and 289–313) is devoted to the study of global supply and demand in a model world, where all money is bank money, elastically supplied, but only for investment purposes. The accounting equality between total product and earned global income does not automatically entail equality between global supply and global demand. The working of a dynamic economy reveals inherent causes of discrepancy between them, giving rise to expansionist and depressive tendencies which intermix in a chance way. It is impossible to suppose, on *a priori* bases, that these tendencies will compensate each other, and if, by any chance, they do, such a compensation would be unstable and imperfect. Furthermore, even a permanent equality of global demand and supply only means stability of employment and prices as a first approximation, for one must take into account shifts between sectors, and sectional disequilibria. After denying the possibility that spontaneous wage and price movements could restore the equality between global supply and demand, M. Gruson raises reasoned doubts about the efficacy of monetary policy, investment demand being only very partially interest-elastic.

The analysis of global demand is particularly interesting. Global demand may differ from earned global income owing to a change in the time lags in income distribution (altering the relation between earned and distributed income) or to a change in liquidity preference (M. Gruson using the Walrasian term "encaisse désirée"). Here, M. Gruson's treatment diverges from Keynes' in a marked way. The speculative motive is relegated to a very auxiliary position, and the "encaisse désirée" is considered as the sum of the transaction balance and of a margin with no definite appropriation taking place in conditions of technical progress or of inflation, which M. Gruson calls "encaisse d'indécision" (irresolution balance).[1] This "encaisse d'indécision" will remain idle, be invested or consumed according to the relative importance of commercial advertising on the one hand, and of the efforts of the banking system to drain disposable funds on the other hand, efforts whose importance depend partly, but only partly, on the rate of interest. The rate of interest itself is explained in a way similar to the loanable funds theory. Unfortunately the analysis of global supply is somewhat scanty : global supply is equal to total product plus (or minus) intended variations in stocks, but hardly anything is said about the factors determining them, e.g., the state and elasticity of expectations. The analysis of pricing reveals some rather strange misconceptions : the conditions given on p. 185 for a shift in spending between two sectors having no effect on employment are neither sufficient nor necessary. The results of pp. 248–49 about the relations between interest costs and price in competition and monopoly are wrong : in pure competition every firm, according to the author, would be run at a loss : " les entreprises ne peuvent rémunérer leurs capitaux que dans la mesure où leur répartition géographique et le coût des transports leur assurent des monopoles locaux " (p. 248). And I cannot see the exact relevance to the problem in hand of the proposition of p. 35 that economic equilibrium is marked by a definite relationship between the value of the stock of capital and the flow of spending, which seems to imply full utilization of capital. However, these shortcomings, which M. Gruson could make good in further editions of his book, do not endanger the validity of his results, nor the interest of his analysis.

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[1] A notion which M. Gruson studied at length in a former paper: "La Préférence pour la Liquidité", in *Economie Appliquée: Archives de l' I.S.E.A.*, Vol. 1, No. 2–3, Aug. 1948.

Another criticism must be directed towards the vocabulary used throughout the book. Not only does M. Gruson baptize familiar concepts with new names (" global disposable savings ", for instance, meaning nothing else than money in his model), but he uses familiar words in most unusual connotations. I wonder, for instance, what Professor Hayek would think of the use of the term " neutral money " to define a quasi-Hawtreyan system with a perfectly elastic supply of bank money. These facts are symptomatic of the state of isolation in which French economic research found itself, owing to the war among other causes. Many efforts are being made to bridge this gap. But it must not be forgotten that the first prerequisite of success is the use of a common vocabulary. Differences in language are unfortunate enough a barrier—it would be still more unfortunate to use a vocabulary which seems alien even in translation.

One must bear in mind in judging the book, that M. Gruson, a senior official of the French Ministry of Finances, is not and never has been an academic economist. This explains the fact that hardly any writer is mentioned beyond Keynes and that M. Gruson is not well acquainted with the mass of highly technical post-Keynesian literature. But I would contend that this is one of the main sources of interest of his work. The reflection of a very intelligent layman on points of pure theory is far too rare an event nowadays. And it is most useful to disentangle the essentials from the mass of scholarly (and sometimes scholastic) refinements which give an esoteric flavour to learned papers. In this line, M. Gruson's reflections are most useful. Not only are some of his analytical conclusions very interesting, but the logical rigour of his analysis, consisting of an almost euclidean chain of definitions and theorems, sets up a welcome example to follow.

G. ROTTIER.

The Webbs and Their Work. Edited by MARGARET COLE. Frederick Muller Ltd. 1949. xvi + 304 pp. 15s. net.

The Fabian progress which led with the "Inevitability of Gradualness" to "Soviet Communism" is of peculiar interest to-day. Nobody has contributed more to fashion the set of beliefs which governs present British policy than did the two Webbs. Everything which helps us to understand the course of their development therefore assists in comprehending not only why we are doing what we are doing but perhaps also in what direction we are moving.

Mrs. Cole's collection of a series of articles commemorative of the Webbs contributes to this understanding in many ways, though not on the point on which further knowledge is most needed, on the development of Sidney Webb until his marriage to Beatrice. Most of the essays deal with the life with which we are familiar from *My Apprenticeship* and *Our Partnership*; and although some of the studies are devoted to activities which were mainly or exclusively Sidney's, such as his work on the L.C.C., in the Labour Party and in the Labour Government, Beatrice holds the stage most of the time. This is a testimony to the personal devotion she inspired in her collaborators; but it cannot be said that they succeed in conveying that feeling to the reader. Neither Mr. Kingsley Martin's story of her describing marriage as "the waste paper basket of the emotions", nor Bernard Shaw's on how she "quite deliberately sampled the Fabians as possible husbands by inviting them down to Gloucestershire for week-ends one after another" make the picture derived from her autobiographical writings more attractive. Nor can the greater interest most of the eighteen contributors to the volume show in her (there is even a chapter by Professor G. D. H. Cole on "Beatrice Webb as an economist", but none on Sidney's distinctive scientific contributions) disguise the fact that Sidney was evidently not only the more solid but also the more original and productive member of the partnership, the actual author even of Beatrice's famous *Minority Report* and apparently of most of what appeared under their joint names. After the ample material we have already been given on Mrs. Webb it is thus still the light it throws on Sidney's career which gives the volume its main interest. Mr. J. S. Middleton's essay on "Webb and the Labour Party" with its representation of Webb as the effective author of *Labour and the New Social Order* (1918) would alone show him as probably the most influential political writer of recent times. Mr. Leonard Woolf in his study on "Political Thought and the Webbs" comes nearest to doing justice to this. It is interesting to have it on his authority that " the conversion [of the Webbs] in old age to Marxian socialism and their admiration of the Soviet system followed logically from their fundamental social philosophy ", and to have this confirmed by Mr. Kingsley Martin who describes *Soviet Communism* as " entirely consistent with the corpus of their previous writings ". It is revealing to learn from Mr. John Parker that Beatrice Webb once told him " that so long as the Russian Revolution went in for any nonsense like Workers' Control they had no interest in it. Once Lenin scrapped any element of Workers' Control in Russia the Webbs began to show some interest in the great Revolution." It is also instructive to read in this connexion the frank discussion by the editor of the " tendencious " character of " Labour Research " and to be reminded by Mr. R. C. K. Ensor in his specially valuable chapter on " Permeation " that even at the time of their imperialistic attitude on the Boer War they were in their own circles " already on other grounds somewhat suspect in regard to liberty ".

One need only add that in addition to those already mentioned, the contributors to the volume include E. R. Pease and F. W. Galton, Lord Beveridge and Desmond MacCarthy, S. K. Ratcliffe and Sir Drummond Shiels, to list only those who at one time or another were closely associated with the Webbs, in order to show how important a contribution to their history the volume is. It would be impossible in a short review even to indicate the various character of the different contributions. They will be indispensable to any student of the intellectual and political history of the period which the activities of the Webbs cover. Yet it makes one feel still more the gap in our knowledge already mentioned. What is mainly required to fill it would be a study of " The Education of Sidney Webb and the Intellectual Origins of *Fabian Essays* ". It would require more systematic research than the present volume. But is this too much to expect from the indefatigable labours of its editor ?

F. A. Hayek.

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The Statistical Approach[1]

By M. G. Kendall

The statistician is popularly regarded as a man who knows nothing except facts; and facts, moreover, which are numerical in nature, that is to say, are of a particularly inhuman and specious kind. It is not easy for anyone reared among the humanities or in the practical world of industry and commerce to believe that a person who apparently spends his time merely in counting or measuring what he observes can, by that process alone, acquire any deep insight into what is really happening. That the statistician is a useful person on occasion is now accepted. That he can make great contributions to scientific methodology is becoming realised. But that he has a unified conception of the world at large, that he derives from his science a satisfaction of those desires for a grasp of the fundamentals of things which lie beyond pure reason—in short, that he has a philosophy—may come to you as a surprising claim.

I could think of no better purpose for this inaugural lecture from the chair to which I have had the honour of being elected than to elucidate this general aspect of my subject and to try to present it to you from the very broadest point of view. I therefore propose to speak, not about particular sets of statistics or particular statistical methods, but about the ideas and motives which lie behind them. I should like you, just for this one occasion perhaps, to see my subject as I see it myself, not as the pedestrian science of handling numerical data, not even as a comparatively new branch of scientific method, but as the matrix of quantitative knowledge of nearly every kind, as the principal instrument yet devised by man for bringing within his grasp the terrifying complexity of things and relations-between-things, and as a powerful illuminant of the process of rational thought itself. It is a great deal to attempt a sketch of the philosophy of the statistical approach in one lecture, but perhaps an inaugural lecture is a suitable occasion and in any case there could be no better place to attempt it than the University where the greatest men of my subject, Karl Pearson, Udny Yule, Ronald Fisher and, may I say it with great pleasure, Sir Arthur Bowley, have done so much of their work. I speak with a profound sense of humility at the thought of following in the footsteps of such men. To maintain their standard of achievement is beyond my powers. But at least I can try to convey something of the impact of their work on our approach to the problems of the modern world.

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[1] Inaugural Lecture given at the London School of Economics on January 17th, 1950.

Since the days when the word "statistics" had the limited connotation of data relating to statecraft my subject has found its most important applications in economic and social fields. It remains true, I think, that the work and welfare of mankind provide the most important domain for statistical inquiry. Certainly that is the common belief; for the layman the word "statistics" is practically synonymous with "economic statistics"—economic, that is, in a broad sense. Indeed, you might suppose that economic and social statistics are relatively much more important nowadays than they were. The advent of the planned economy is generally considered to have created a statistician's paradise, and however regrettable this creation may be it is accepted by most people as inevitable. The statistician, indeed, is now much more than a handmaiden to a planned society. Very often his work tells it what it must plan. I need not give more than one example; since 1939 the population of the world has probably increased by 6 to 7 per cent. and its food supply is not keeping pace, particularly as higher standards of nutrition are adopted in backward countries. The shadow of Malthus falls again across the world; and that great man, let us remember, was one of the first statisticians and a member of the small group which founded the Royal Statistical Society.

The emphasis laid on statistics by the economic and social sciences historically and practically has tended to obscure the fact that from the methodological viewpoint economic statistics forms only a small part of the whole field of the subject of statistics at the present time. To give an idea of the extraordinary range of my subject as it now exists I take some examples more or less at random from the work of the past twenty-five years. In agriculture the whole theory and practice of plant breeding and of field trials has been revolutionised. In industry the spread of statistical methods of quality control has been as rapid as it has been successful. In meteorology the statistician is at last getting to grips with the enigmatic behaviour of the weather. In nuclear physics the statistical approach is now a basic part of the subject. To take more particular instances, statistical methods are used in the study of epidemics, telephone traffic, industrial accidents, the standardisation of drugs, the measurement of human abilities, the migration of insects, the efficiency of examiners, the building-times of pre-fabricated houses, the distribution of blood-groups, factory production costs, flutter in aircraft structure, and in fact in almost every branch of science and industry. The statistician does not indeed stop there. He is extending his interests into domains which have not hitherto been considered as possible fields for the application of numerical methods. The chronology of ancient history, the dating of the books of the Rigveda, the credibility of witnesses, telepathic communication, have all been brought under the statistical microscope. Not long ago I heard of an enquiry into the distribution of intervals between successive notes in some of William Byrd's madrigals, and within the last week my attention was drawn to a thesis on the use of discriminant functions for handicapping horses. Some subjects, it is true, are not contaminated by the irritating exactitude of numerical expression. Poetry, Drama and Theology have a natural immunity to scientific enquiry. But one never knows what may happen.

Frankly, I enjoy making this kind of catalogue, but it is not the diversity of the applications of statistical methods to which I wish to direct attention. Their significant feature is the unity of the underlying method of approach. We are constantly finding that a technique evolved for one purpose can easily be adapted to another. Many years ago Karl Pearson was interested in the spread of mosquitoes under random migration from a malarial site. The problem of the random walk which he studied has today found applications to the spread of disease, the diffusion of gases, Brownian movement and most recently in three dimensions to investigations into the molecular structure of rubber. Some work by Cayley on a type of mathematical network known as a tree has been applied in sociology (to the study of the propagation of rumour) and in economics (to the study of systems of accounts). Three-quarters of the way through the nineteenth century Whitworth posed and solved a problem concerning the distribution of the size of pieces of a stick which is broken at random at a given number of points. His results have been applied to the design of traffic-light systems, bomb fragmentation, the detection of trade cycles, and the analysis of noise. Twenty years ago Yule wrote a famous study of sunspots. It is not surprising that his methods should have been applied to forecasting stock-market fluctuations and the study of variations in crop-yields ; but it is odd to find them turning up in studies of the standardisation of cotton thread, the preparation of polished metal surfaces, cosmic-ray showers and the design of gun turrets. Methods devised for comparing the performance of students in different subjects have been applied to studies of wool grading, social stratification, the efficiency of card-shuffling processes and the effect of bombing on civilian morale. From these examples you will not wonder that the statistician who contemplates his subject as a whole, who traces an idea or a method continuously from one end of science to the other, occasionally feels as if there lies beneath his hand something of the basic fabric of rational thought. And this is to say nothing of the problem of sampling, which brings him into contact with every type of inquiry where the data available are only a part of the data in existence. Wherever two or three are gathered together, experimentally speaking, there is scope for the application of the statistical method.

But I have not yet mentioned the distinguishing features of the statistical approach. What I have been saying, after all, amounts to no more than this, that the statistical method is widespread because numerical data arise in most branches of organised knowledge. Like mathematics it is a scientific method, and a method which is scientific is *ipso facto* capable of general application. The mere ubiquity of the statistical approach, then, striking as it may be, is not its most important feature. What marks it out for special attention is that it deals, not with individuals, but with aggregates. Statistics is the science of collectives and group properties. The statistician is interested in the individual only as the member of a group. It is from this basic fact that his strength and his weakness both arise. His strength because most, if not all, natural laws are group properties ; his weakness because he sometimes throws into a group individuals which are not homogeneous and misses something in his summarisations. His common sense usually saves him. That is why all good statisticians lay such emphasis on the importance of common sense. But we should in fairness admit that he is in danger of failing to see the trees for the wood. It is inevitable that he should be so, for one cannot watch the aggregate and at the same time keep every item of it in focus.

In general the laws obeyed by collectives are determined empirically and a large part of statistical technique is concerned with the setting up of a calculus of collective phenomena to handle observations in the aggregate. But there are also laws of a peculiar kind in mass action which permit of the prediction of the behaviour of an aggregate when it is quite impossible to frame laws concerning the individual. We are permitted, in a sense, to derive law from the actual absence of law. In fact, under certain conditions, the more numerous the perturbative influences at work on the individual, the more definite the law obeyed by the aggregate. We may go further still. There are certain aggregates, called random or stochastic, the members of which not only do not conform to law in the older sense of nineteenth-century determinism but are actually *conceived* of as not conforming to any such law. We say that they happen by chance. And yet we can derive quite definite laws which are obeyed by aggregates of such individuals and we can say without paradox that chance is subject to law.

The statistician, then, tends to think in terms of aggregates and the laws of group properties. This gives him a distinctive outlook on life which, without perhaps crystallizing into an explicit philosophy, is nevertheless formative of his attitude and his approach towards philosophical problems. Far from rendering him remote and inhuman it sometimes produces a sense of collective unity which is one of the features of the best religions. I give one or two illustrations.

There is a statistical law, known by the name of the French mathematician Poisson, expressing the fact that even relatively rare events happening at random have a definite pattern of behaviour. Practically every text-book written in the past forty years has exemplified this law by quoting some data collected by von Bortkiewicz concerning the number of officers in the Prussian cavalry corps who were killed by the kick of a horse. The example is so hackneyed that a bored reader once wrote to me imploring me to vary it. Now good statistical examples are hard to find, but on this occasion Mr. R. E. D. Clarke came to the rescue with the results of an examination of the fall of V 1 flying bombs in an area in South London. The object of the inquiry was to ascertain whether there was any ground for the belief that the bombs fell in clusters otherwise than by chance. The data showed that they did not and that the distribution was almost perfectly represented by the Poisson law. The statistician derives some pleasure from the reflection that while the science of war developed from the cavalry charge of 1865 to the flying bomb of 1945 the laws which interest him, the laws of homogeneous chaos, remained immutable.

I take a more serious illustration. At this moment there are alive and well in this country about a dozen people who will have been killed in road accidents by this time tomorrow evening. Who they are, where they are, or what they are it is impossible to foresee. But the statistician can foresee that they are somewhere. Doubtless the incidence of random deaths of this character could be prevented; but doubtless it will not be prevented, at least by tomorrow evening. The threat of the random event lies over us all. We flatter ourselves that we control our destiny, and in one sense perhaps we do; but most of us, I think, when we look back over the major incidents of our lives, are disturbed at the large element of chance which seems to control us.

It gives one a curious feeling of identity with the aggregate of humanity to reflect on this fact. One does not expect to find a quotation apposite to a statistical point in the sermons of a mystic, but I think John Donne was expressing this idea when he wrote: "Ask not, then, for whom the bell tolls. It is for *thee*." I mention this element of mysticism in the subject, not to develop the theme, for that would be out of place on this occasion, but to call attention to its existence; for there is, I hold, some such element at the root of all creative scientific endeavour, and statistics is no exception to the rule.

You must not misunderstand me. I am not attempting to draw a portrait of the statistician as a fatalist, resigned to inexorable random misfortune, or as a Pythagorean mystic looking for truth, beauty and virtue in the properties of numbers themselves. He is just as prosaic in ordinary life as anyone else, and more prosaic than some. Beneath the bludgeonings of chance his head is not picturesquely bloody or defiantly unbowed. It is much more likely to be working out the premiums on an insurance policy. At the same time, I must point out that his mind is not a mere collection of facts like a blue book. He has an attitude. Very definitely, he has an attitude.

The statistician even has a sort of fellow-feeling with Nature herself; not, I mean, in the flower-in-the-crannied-wall or the little-lamb-who-made-thee sense, but arising from the fact that Nature behaves in the statistical manner in some of her most important operations. She equips her creatures individually with some excellent weapons, but, recognising that she cannot hope to provide against every contingency, relies for the survival of the species on sheer weight of numbers. The herring and the oyster spawn in millions; the law of averages will see to it that some of their offspring survive. Nature, in fact, does not shoot at her targets with a weapon of high precision; she sprays them with a shot-gun. She has the statistical approach. It is of some interest to observe in passing that military authorities are catching up with her in this respect; on land the rifle is giving way to the tommy gun; at sea the submarine hunts in packs; in the air precision bombing makes way for a general plastering of the target area.

While we are on this high level, I might mention that the fate of the whole universe seems to be deciding itself on a statistical basis. So far as we can see the universe of things physical in its present form is rather improbable. Its matter and its energy are concentrated in heaps in a way which could hardly have happened if they had been scattered at random. But energy is being constantly radiated and matter appears to be transformed into energy. Consequently the universe is becoming more and more random, more and more unorganised. In technical terms, its entropy, the negative of the logarithm of the statistical probability of things, is increasing. There are theorems, known as ergodic, the effect of which is that under the laws of chance the ultimate state is more or less uniform independently of what the initial state might have been. The statistician, then, must look at the universe as a sort of Manichean struggle between the spread of chaos as energy is sprayed into space and the reverse process of organisation, which seems to be one of the characteristics of what we call life. It would be rash to draw conclusions from all this. The fact that the universe is unlikely does not prove that it must have been arranged from primordial chaos by an intelligence. The fact that it is dissipating its energy does not mean that it will always do so. Certainly it does not warrant on the statistician's part a pessimistic assumption that chaos is bound to win. Statisticians, in fact, are usually optimists; they have to be, to submit to the tedious discipline of their subject. But I need not elaborate the point. Statistical considerations will probably not affect our basic feelings on such matters which, I gather, are more dependent on the secretion of one's endocrine glands than on knowledge.

It is perhaps time that I came down to earth; but before I consider the statistical approach to a few of the more human current topics I should like to interpolate some comments on the relationship between statistics and mathematics, for there is an impression that one is a branch of the other which I feel it highly desirable to try to dispel. As is only natural for a science which depends so much on numbers, the theory of statistics is essentially mathematical in its modes of expression and even, to some extent, in its modes of thought. It draws freely on the language and theorems of mathematics. Indeed, it has stimulated a great deal of research into pure mathematics and there is hardly a branch of that subject which has not been overhauled and refurbished in recent years to meet some statistical requirement. In spite of this I must hold firm to the thesis that statistics is not a branch of mathematics. It is not a branch of any subject. It is a subject in itself. R. A. Fisher is often quoted as the authority for the statement that statistics is a branch of *applied* mathematics. But I think he meant—I hope he meant—that statistics is a subject in which extensive use is made of mathematics, as for example in astronomy or engineering. His dictum has not always been understood in that sense. It has become the custom to give the name "applied mathematics" to branches of pure mathematics dressed up in the guise of certain of the physical sciences. In that sense statistics is not a branch of applied mathematics. There are fundamental concepts in statistics which find no place in mathematics.

Indeed, in one respect the two are antithetical, for one is a theory of uncertain, the other of certain, inference.

Mathematics, in fact, like fire, is a good servant but a bad master. At its worst—or perhaps at its best, I make no ethical judgment—it is a form of escape from reality. The most recent developments in mathematical statistics give rise to some anxiety on the part of the theoretical statistician. I think we have to acknowledge quite frankly that some mathematicians enjoy being cryptic and that others are constrained to parade their learning in order to maintain a place in the struggle for scientific recognition. There is, of course, a need for rigorous mathematical exposition in statistical theory, and some of it can be put only in language which is intelligible only to the expert. Nevertheless I feel sometimes, in wrestling with papers on statistical matters with a full emblazonment of modern mathematics, sets of points, Lebesgue integration, asymptotic summability and so forth, that work which achieves a slight gain in generality at the expense of being incomprehensible is defeating its own purpose. The mathematician, I suggest, ought to have some small responsibility for making himself understood. One of the few doctrinal points on which all statisticians seem to agree is the necessity for keeping one foot firmly on the ground. If we look at the theory of time-series, for instance, we find that any theoretical results of importance have sprung directly from an attack on a practical problem. Statistics, like all progressive sciences, is experimental. You will forgive me, I hope, if I appear to labour this point but it is particularly important at the present time because we have reached a critical phase in the development of statistical method when pure mathematicians looking for something to research on are throwing up such a dust that the practical nature of the subject is being obscured and theoretical statistics is in danger of being discredited in the eyes of the more practical man.

I return to consider the statistical approach to more urgent human affairs ; I shall not attempt a comprehensive survey ; you are all aware of the importance of the statistical approach on such matters as national finance, the manpower problem, land utilisation and commercial organisation. In order to illustrate the statistical approach, as distinct from the collection and analysis of statistical data, I deliberately choose as illustrations three topics drawn from fields in which the statistical approach has not been regarded as particularly important, one from each of sociology, politics and social ethics. It must be made plain at the outset that the statistician—at least, this particular statistician—has no desire to poach on other people's preserves. He likes to be invited to inspect his neighbour's grounds but he does not trespass. The last thing I want to suggest is that he can teach their business to the experts in other fields. My point is rather that the statistician, in virtue of his subject, acquires an approach to certain problems of human organisation which might prove suggestive to his fellow workers. The statistician is not, and makes no claim to be, a sociologist, a politician or a moral philosopher ; but he may, perhaps, be allowed to suggest that the statistical approach, in the sense in which I am using the term in this lecture, should not be overlooked in the subjects with which they are concerned.

(*a*) First of all, an example from social economics or economic sociology, whichever you prefer. Since Pareto drew attention to the law of distribution of income the social trend has been towards greater equality in the distribution of the national product. Some people seem to want to go to the extreme. Others think that there are dangers that we have already gone too far in the direction of simple egalitarianism. But nobody seems to think it necessary to announce exactly what it is we are trying to do. Does anybody know, or has anybody tried to work out, what the distribution of incomes ought to be or could be made to be under different hypothesis ? It is not obvious, and it may not even be true, that the greatest good is assured to the greatest number by narrowing the dispersion of incomes. If we once admit that there should be inequalities, however restricted, between incomes the question immediately arises : how should incomes be distributed ? If a foreman is to receive more than a workman under his charge, how much more ? What determines the ratio of the salaries of a chairman and a vice-chairman of a company ? I am all too well aware that the answers to these questions are not to be sought in statistics alone ; but I think that the statistical approach may contribute something towards finding them if only by showing that certain solutions are impossible. It might, for example, be possible to show that the social pyramid must obey certain laws if it is to be stable and self-perpetuating. It might be found that a certain number of plums must be left in the national cake for private consumption if certain social policies are not to collapse, and if so, the statistician might be able to say how many there should be. My colleagues in sociology will, I hope, forgive me for putting forward these rather naïve ideas without showing just what the statistician can do to help. I cannot stay to develop them. My point is made if it is agreed that the hedonic calculus stands in need of a statistical overhaul.

(*b*) In the political field there are some interesting statistical conclusions to be drawn from the fact that we live under a system of government by committee. We all know what happens when one or two members of a decisional group are armed with a veto ; perhaps we do not quite appreciate their power when they are not so armed. Professor Penrose recently has discussed what might be termed the Law of the Resolute Minority in organisations wherein members have equal voting rights. If the majority of a committee are indifferent the minority will nearly always get its way. Within the last few days interest has been aroused by the empirical law that the number of seats obtained in an election by a party varies as the cube of the number of votes cast for it. Again I cannot dwell on the theme, fascinating as it is. It leads to studies of such matters as the power of the floating vote, proportional representation, the laws of inertia of voting groups, and the optimum sizes of executive bodies—none of them statistical subjects, but all of them subjects on which the statistician has something to say in virtue of his expertise in the properties of aggregates.

(*c*) And now a rather extreme example. Strong feelings have been aroused in the last year or so by the proposal to abolish capital punishment. During the discussions both in Parliament and outside a suggestion that the death penalty be suspended for a fixed period was usually described as an experiment. No statistician, so far as I know, bothered to point out that it was nothing of the kind and that any data obtained during a period of temporary suspension would be valueless unless there were a control—if the murder rate went down the proponents of abolition would say that they told us so and the opponents would say that it would have gone down in any case ; and if it goes up their positions would be interchanged. In either case the data are inconclusive. However, I am not referring to the difficulties of interpreting criminal statistics. Nor do I think the statistician has anything to say on the ethics of the question whether a community has a moral right to eliminate any of its members, for reasons of public safety as with traitors and murderers, for eugenic reasons as in the sterilisation of the unfit, or for economic reasons as in the case of proposals to put to death the hopeless idiot and the incurable lunatic. The point is that however one looks at such questions, as relating to economics, morals or ethics, the problem, if we can free ourselves from the emotional aura of the subject, is one of balancing the interests of the individual against those of his community. It arises directly from the inter-relationships of a group of individuals and as such it is statistical. Of course I do not mean that it can be solved on a calculating machine or by consulting tables of the normal integral. But *conceptually* it is statistical. If there is a rational solution it must be in statistical terms.

I turn now to a rather different field, the statistical approach in logic and scientific inference. I have already referred to certain laws obeyed by aggregates of a particular kind, such as the so-called Law of Large Numbers and the Principle of the Permanence of Statistical Ratios. Such laws are not categorically imperative in the sense that they operate inevitably or in the sense in which Eddington regarded certain non-dimensional physical constants as imposed by the intrinsic properties of our way of looking at space, time and matter. Strictly speaking there are no *a priori* laws in statistics any more than in any experimental science; and the modern form of the law of large numbers, to the purist, shares with the Holy Roman Empire, the English horn, the Jerusalem artichoke and several statistical concepts the interesting property of not being accurately described by any of the constituents of its own name, being neither a universal law nor confined in its application to large numbers. Nevertheless we do find that many aggregates conform in practice to the required pattern. There do exist aggregates of random occurrences and there do exist stochastic processes. The diversity of the applications of statistical methods which I mentioned at the beginning is sufficient testimony to the fact. In most sampling inquiries, of course, we arrange for them to appear by sampling at random.

In particular it appears that error itself behaves stochastically. This again is one of the main reasons why the statistical method has such widespread applications. Any system of physical measurement has its error function which is capable of statistical investigation. Any system of sampling has an inherent error, and the reason we try to arrange for it to incorporate a random element is that we then bring the error under statistical control. We can never predict the behaviour of the error on any given occasion, but we can predict the behaviour of aggregates of errors; and hence we can make exact statements, not about the behaviour of the individual but about its *probable* behaviour.

This brings me to another characteristic, perhaps the most characteristic, feature of the statistical method. It recognises frankly that outside the domain of pure mathematics, deductive logic itself and similar subjects which are concerned with logical relations between ideas or the syntactic construction of languages, few, if any, meaningful statements are certain. We all know this but it took mankind at least two thousand years to admit it officially; and it was very natural that there should be a reluctance to admit it because once we admit that everything is uncertain we appear to undermine any system of rational thought. Leibniz appears to have been the first to state explicitly the necessity for a probabilistic logic, but the belief that it was possible to derive by inward contemplation certain propositions about the natural world lived long after his time and still survives in some quarters. Even Descartes wrote in the deductive manner and Spinoza contemplated writing his ethics on the model of Euclid's geometry. And it is strange how dialectical materialism, which as I understand it is another name for the scientific method, lends itself to the assertion of the wildest dogmata.

In atomic physics the position has been reached wherein the measurement of position is *theoretically* impossible. A particle can be observed only by the emission of light-energy which itself can only occur if the particle has moved somewhere else. This principle of uncertainty has given the theory of probability a fundamental rôle in quantum mechanics. At the other end of the cosmic scale it is equally true that we can observe the outer stars only as they were millions of light-years ago when they emitted the signals now reaching us. What they are like now (if there is a cosmic Now) we cannot possibly determine. The statistician, as Pascal remarked of man in general, is poised between the infinitely small and the infinitely great. Normally his problems are not so essentially indeterminate as in quantum physics, but there is an element of uncertainty surrounding them. What used to be regarded as an exact measurement of a single magnitude is to him a distribution of observations with perhaps a mean but not a unique "true" value. In the nineteenth century the object of the scientist was to draw a picture of the universe in sharp deterministic lines. Nowadays those lines are blurred by error distributions and the determinism of the individual has given way to the determinism of the aggregate. We see things hazily not because our vision is defective but because it is so clear. Nevertheless we can still paint a picture of the universe which is accurate and æsthetically satisfying. The only point to remember is that, as with pictorial works of art generally, you must not stand too close to the canvas.

The theory of probability, as developed by the statistician, is in fact the theory of uncertain inference in fields of a special type. It admits that uncertainty is the general rule rather than the exception but does not despair on that account of setting up a system of rational inference. I must be a little careful here because whatever one says about probability is almost certain to be contradicted by someone; but I think I am on non-contentious ground in stating that the statistician is in a peculiarly advantageous position to utilise the theory of probability because of the explicit character of the sets of propositions which concern him. He can say nothing certain about the error on a particular occasion; but he can make a definite statement about its probability. He may be wrong on any one occasion, but he makes up for it on the other occasions when he is right. He can even *measure* the relative risks of being wrong on different hypotheses. And thus, accepting the tangled complexity of observed phenomena and the essential uncertainty of the future, he gauges his uncertainties, measures his degrees of confidence and does his best to provide an objective basis for rational judgment and rational action. It is not in mortals to command success but the statistician does more. He measures the risk of failure.

How he performs this feat, how he constructs his standard errors and his confidence belts, how he designs his inquiries so as to measure their own error, how he decides whether to attribute significance to an observed effect, I must refer to the text-books. But before I leave this point I have to correct one possible wrong impression. It is not claimed that all uncertain inference or all use of the theory of probability lies in the statistical field. There are important and uncertain propositions on which statistics can throw no light whatever. The statistician has, perhaps, been tempted to appropriate the whole domain of uncertain inference, if only because up to the present he has explored it most scientifically and has produced the most fruitful results from it. But I do not want to give the impression that he is trying to crowd out the logician and the philosopher from a region which is, or ought to be, peculiarly their own. He is lucky in that numerical expression gives him an advantage in precision, but he makes no claim to a monopoly of accurate inferential processes.

Apart from the theory of inference itself there is another field where the concept of randomness and stochastic happening may throw some light on the nature of reflective thought. I refer to the theory of machines. We have heard a good deal in the last year or so about the remarkable power of the electronic computer. It has been described, with no justification at all, as an electric brain. But up to the present any machine, electric or not, only does what its maker designs it to do. Remarkable as its achievements are, it is no more a brain in the customary sense than a magnifying glass is an eye. But it may be possible to construct machines which do not follow throughout a purposive routine laid down by a designer; they may incorporate a randomising element. In such circumstances the machine might do things which the designer did not foresee. It would still not be capable of independent thinking, for the results which it produced would only be judged by it as sensible against some criteria built into it by the designer. But it might achieve sensible results by means which the designer does not understand. I am inclined to think that this is the sort of thing which happens in our own minds when, as we say, we meditate on a question. The mind thrashes about in a more or less haphazard way until something clicks into place and a sensible result emerges. I make this suggestion very tentatively; but it seems to me a profitable line for the psychologist to follow to see whether we can explain the capacity of the reflective mind to jump to conclusions which afterwards turn out to be correct in terms of statistical rather than logically purposeful trains of thought.

If I have expressed myself intelligibly you will now understand what I meant in my opening sentences by saying that the statistician derives from his science an approach to many of the problems which are, for want of a better name, called philosophical. But on reaching this stage I am left with one rather uncomfortable feeling. The purpose of this lecture was to give you some account of my subject in relation to other branches of knowledge, but I am not sure whether what was intended as an objective statement of fact may not have sounded more like an éloge. If you notice, as you well may notice, a certain air of self-satisfaction about modern statisticians, I hope you will not be misled by it. It is one of the features of a youthful science that it tends to exaggerate its own importance, and the halo-effect among statisticians is to be regarded with indulgence as an occupational ailment like writer's scoliosis or computer's elbow, all of which afflict the statistician but all of which are amenable to treatment. There is, indeed, one thing which chastens him to the point of desperation. If he turns from a contemplation of the past achievements of his science to look at the future field awaiting his labours he needs no other discipline to bring home to him an urgent sense of inadequacy. In each of the main categories of theoretical statistics, for example, the theory of distribution, the theory of statistical relationship, the the theory of sampling and the theory of inference, it is possible to write down enough questions to keep a team of research workers going for the rest of their lives. But to describe in any detail what we do not know about statistics would need an encyclopædic ignorance. I shall merely refer to two particular fields which may give a sufficient idea of what lies in store for us.

In the past thirty years there have been astonishing developments in the mathematical theory of statistics, most of it being built on the basis of the theory of probability in random sampling. The mine is far from being worked out; but it is being found, particularly in those sciences where the human being enters as sampler or samplee, that the theory of random sampling is not enough. Substantial and peculiar forms of bias appear whenever the human judgment is given any latitude in selecting, measuring or recording a sample ; the proneness of a human being not to tell the truth, the whole truth and nothing but the truth in response to a statistical inquiry is well known ; and there also appear to be interaction effects between the human being as interviewer and the human being as interviewee. We know that these dangerous forms of bias exist ; and in some cases we know a little about their form and magnitude. But on the whole we know regrettably little about them—certainly not as much as we should like to know or intend to know. I myself would expect that the next major development in our subject will be the accumulation of experimental work on the sources and nature of bias. Once the data are collected we may hope to be able to formulate the laws of bias, and mathematics can then take us a stage further in the theory of representative sampling. In practice, of course, the two things will develop concurrently ; but if we must consider the subject as an alternation of practical and theoretical discovery, I think the next phase is a practical one. We must try to develop a theory of bias in sampling, but it will not be drawn from the air. I may remark in passing that this development, if it occurs, will accentuate difficulties in which we already find ourselves in connection with the teaching of statistics, the organisation of statistical research and the formation of research units. One of the problems which statisticians have not yet solved—or perhaps it would be better to say, have not been permitted by extraneous circumstances to solve—is how to distribute statistical work and statistical teaching. But that is a theme which I hope to develop on another occasion.

As a second example of future developments, this time in a theoretical field but with the greatest practical implications, I take the theory of experimentation. One very important branch of statistical theory is devoted to the design of experiments so as to economise in time and labour and to ensure that the statistician can answer the questions which are going to be put to him when the experiments are completed. Now the classical experiment was performed in a laboratory under very carefully controlled conditions. The investigator's ideal was to design an experimental set-up in which only the factors of immediate interest were permitted to vary, everything else being held constant. The statistical approach is quite different. It accepts, in the first place, the fact that a good many experiments cannot be performed under laboratory conditions, but it goes much further than that and makes a virtue of necessity by designing its enquiries so that all the errors likely to be met in practice can in fact occur and be measured as a single error term. In the laboratory errors are, so far as possible, excluded. In the field they are permitted full play and even, one might say, encouraged to show themselves.

This situation, as you will see, is likely to lead to a Great Schism in the scientific church unless it is carefully handled. The laboratory worker is apt to claim that the field worker is so beset by error that he cannot isolate his causative factors; the field worker would retort that the results of the laboratory worker cannot be applied outside the laboratory because the circumstances are not such as can be encountered in real life. This is much more than an academic argument. It came to a head in the war in connection with that undefined type of activity known as operational research when it was found, for example, that picking out aircraft pilots by their success in laboratory tests of ability to judge distance in depth did not have any appreciable effect in diminishing the number of landing crashes due to misjudgment. In one way the conflict looks more serious than it is. One easy way of resolving it is to do experiments both in the laboratory and in the field, which is what we should all do in practice if we had the time and money. Unfortunately we have to economise in both, and that is where the difficulties are likely to arise. What part the statistician has to play in a settlement of them I should hardly like to surmise; but it is clear that he cannot stand entirely aloof.

I have ranged today over a very wide field. You may well have thought, when I was speaking of the statistical approach to subjects such as inference in probability, the abolition of the death penalty or road accidents, that if that is what I mean by statistics we are all statisticians. And, indeed, if it is not an impertinence to say so, I think that is broadly true. It is almost impossible to be a responsible adult in the modern world without acquiring the statistical outlook to some extent, whether one spends one's time in speculation on the nature of things or in filling up football pool coupons. There is in essence nothing unusual or mysterious about the statistical approach. There is nothing *outré* or suspicious about the statistician. The only thing that distinguishes him from his fellows is that he specialises. And so, having imposed on you these general reflections, I return to my own specialised domain.

The London School of Economics.

Distribution of Incomes in the United Kingdom in 1938 and 1947

By E. C. RHODES

1. In the white paper on National Income and Expenditure of the United Kingdom, 1946 to 1948, Cmd. 7649, April, 1949, a table is given showing the distribution of personal incomes by ranges of income. It appears that the distribution for 1947 can be fairly described in simple mathematical terms as the sum of two Pareto distributions :

$$n = A x^{-\alpha} + B x^{-\beta} \text{ or } z = \frac{A\alpha}{\alpha - 1} x^{-\alpha+1} + \frac{B\beta}{\beta - 1} x^{-\beta+1},$$

where n is the number of incomes greater than £x, and £z is the amount of income possessed by the n income receivers. The original data are given in the table below together with the aggregated quantities n and z.

TABLE I.

Income Ranges (£)	*Number of Incomes* (000)	*Amount of Income* (£*mn*)	(£x) *Income*	*Cumulated figures* n(000)	z(£*mn*)
Under 250	—	2,480			
250–499	7,900	2,690	—	—	7,829
500–999	1,850	1,224	250	10,410	5,349
1,000–1,999	485	654	500	2,510	2,659
2,000–9,999	165	597	1,000	660	1,435
10,000 and over	10	184	2,000	175	781
			10,000	10	184
TOTAL ..	10,410	7,829			

No attempt is made, in the original table, to estimate either the total number of incomes or the lowest income (under £250). But it is estimated that the total income is £7,829 mn.

The computations for the constants of the formula to be applied to these data were made on the original figures for z.

We found $A = 10^{18} \times 6.177$, $\alpha = 5.240$, $B = 10^{11} \times 2.850$, $\beta = 1.876$. The computed n's and z's are set out in the table below :

TABLE II.

Income (£x)	$Ax^{-\alpha}$ (000)	$Bx^{-\beta}$ (000)	n (000)	$\frac{A\alpha}{\alpha-1}x^{-\alpha+1}$ (£mn)	$\frac{B\beta}{\beta-1}x^{-\beta+1}$ (£mn)	z (£mn)
250	1,677.1	9,024.9	10,702	518.2	4,830.9	5,349
500	44.4	2,458.2	2,503	27.4	2631.6	2,659
1,000	1.2	669.5	671	1.5	1433.5	1,435
2,000	0.0	182.4	182	0.1	780.9	781
10,000	0.0	8.9	9	0.0	190.6	191

The values of z agree with the original values in Table I, with the exception of that for $x = 10{,}000$ where our formula gives 191 instead of 184, a difference of about 3½ per cent. The values of n correspond fairly well; there is an error of about 3 per cent. in the n for £250 and of about 4 per cent. in the n for £2,000. The formula gives 9,000 incomes greater than £10,000 instead of 10,000 in the original table.

The agreement between the original data and the figures derived from these formulæ is thus fairly close. It is an easy matter, now, to make speculations about the distribution below £250, on which matter the official data are reticent. We are told that the aggregate of all incomes is £7,829 mn. Let us imagine that our formulæ hold good for values of x below 250. On this assumption, we can compute from the formula for what value of x we get z equal to 7,829. We find this value of x is 189.6. Thus, assuming our formulæ to give the distribution below £250, the total income overall is consistent with a lowest income figure of about £190. From this we can compute the aggregate number of incomes, which is 22,300,000. These results are not satisfactory. The estimate of the total number of incomes, 22·3 million, seems to be likely to be near the true figure, but the lowest income figure given by our formulæ, £190, appears to be very different from the truth. It is always difficult to extrapolate a formula for income distributions beyond the range to which it applies.

2. In the same white paper there are given similar data for 1938. It appears that these data may be described in simple mathematical terms by means of a single Pareto distribution with fair accuracy.

In the table below the original data are shown with the derived cumulated figures, n and z.

TABLE III.

Income Ranges (£)	*Number of Incomes* (000)	*Amount of Income* (£*mn*)	*Cumulated Figures* *Income* (£)	*n*(000)	*z*(£*mn*)	*Formulae* *n*(000)	*z*(£*mn*)
Under 250	—	2,463	—	—	4,436		
250–499	2,000	679	250	3,000	1,973	3,118	2,005
500–999	670	455	500	1,000	1,294	1,003	1,290
1,000–1,999	224	304	1,000	330	839	323	830
2,000–9,999	98	360	2,000	106	535	104	534
10,000 and over	8	175	10,000	8	175	7	192
TOTAL	3,000	4,436					

The constants for the formulæ $n = Ax^{-\alpha}$, $z = \dfrac{A\alpha}{\alpha - 1} x^{-\alpha+1}$ to be applied to these data were obtained by using both the original data for n and z, omitting the final figures for $x = 10{,}000$.

It appears that $A = 10^{10} \times 2{\cdot}612$, $\alpha = 1{\cdot}636$.

The values of n and z for the appropriate values of x obtained from the formulæ are also shown in Table III. There is about 3 per cent. error in n for $x = 250$ and there are less relative errors in the values of n for the other values of x, except for 10,000. The errors in the z– values are about two per cent. for $x = 250$, less for the other values of x, and about 10 per cent. for $x = 10{,}000$. The agreement between the original data and the theoretical figures seems fairly close.

If we attempt to extrapolate backwards for values of x below 250, to find the lowest income on the assumption that the distribution below £250 is the same single Pareto distribution which emerges from our work, we can use the aggregate income £4,436 mn to estimate the lowest income as £71·7, and to estimate from this the total number of incomes overall as 24,040,000. This figure seems to be too high for the year 1938, and it does not seem to be possible that the incomes over the whole range are likely to be distributed according to the simple Pareto law. So the results of these last computations will not be used further.

3. It is natural that we should desire to make other comparisons between the income distributions of 1938 and 1947. Owing to the difficulties of dealing at all adequately with the distribution of incomes below £250, we will restrict our attention to the 3 million incomes greater than £250 in 1938 and to the 10,410,000 incomes greater than £250 in 1947. The average income in 1938 of those with more

than £250 is £658. In 1947 the corresponding figure is £514. In 1947, there is more concentration of incomes in the range £250—£499 than in 1938, 76 per cent. against 67 per cent. in 1938. A convenient measure of concentration is afforded by the *mean difference.* This measure is obtained by adding the positive differences between every pair of incomes, and dividing by the total number of these pairs. The mean difference in 1938 of the incomes greater than £250 is £585, the corresponding figure for 1947 is £357. There is less variability in the group in 1947 than in 1938. The relative mean difference, taking the ratio of the mean difference to the average, is a better index of concentration. In 1938, the relative mean difference is 0·88, in 1947 it is 0·69.

It may be argued that we ought not to compare the 3,000,000 incomes greater than £250 in 1938 with the 10,410,000 incomes greater than £250 in 1947, as the lower incomes in the latter group are more properly comparable with incomes less than £250 in 1938. We can compute the lowest income in 1947 comparable with £250 in 1938. In 1947, there were 2,510,000 incomes greater than £500. We find that there were 3,007,000 incomes in 1947 greater than £455, assuming that the 1947 distribution is describable as the sum of the two Pareto distributions already mentioned. Thus £250 in 1938 appears to correspond with £455 in 1947, an increase of about 80 per cent. The average income of the 3,007,000 incomes greater than £455 in 1947 is £964, an increase of about 45 per cent. from £658. The mean difference of this group of 3,007,000 incomes greater than £455 in 1947 is £696. This compares with £585, the mean difference of the 3 million incomes greater than £250 in 1938. The relative mean difference of this group of 3,007,000 incomes in 1947 is 0·72, which is less than the figure 0·88 for the 3 million incomes in 1938. Thus there is less relative variability in 1947, in a comparable group, than in 1938.

4. In the Inland Revenue Report for the year ending March 31st, 1948 (Cmd. 7738, July, 1949), we are given provisional figures for the distribution of 21 million incomes ranging upwards from £120 in 1947–48. The data in the cumulative form are given in Table IV.

These data contain some figures identical with corresponding figures in Table I (for 1947). The figures are the same at £10,000 and at £2,000 incomes, nearly the same at £1,000. The aggregate incomes differ by £304 mn. No attempt

TABLE IV.

Distribution of Incomes, 1947–48.

Income £	*n* (000)	*z* (£*mn*)
120	21,000	7,525
250	11,625	5,795
500	2,625	2,737
750	1,135	1,842
1,000	660	1,434
1,500	305	1,002
2,000	175	781
3,000	94·5	585
5,000	37·8	370
10,000	10·0	184
20,000	2·2	79

has been made to fit a mathematical formula to these data. We can, however, estimate the relative mean difference. For the whole range of incomes from £120 upwards, this is 0·73. The average income is £358, the mean difference is £261. For incomes above £250, the relative mean difference is 0·67, the average income is £498 and the mean difference is £332. Previously, from the white paper figures for 1947, we computed the relative mean difference as 0·69.

These data for 1947–48 give us an estimated distribution of probably 90 per cent. of the incomes in that year, and range from the very low figure of £120 upwards. For the whole range the relative mean difference is 0·73 and for incomes above £250 it is 0·67. Thus there is more relative variation when the incomes between £120 and £250 are taken into account. We estimate that there were 4,113,000 incomes greater than £400 in 1947–48 and for this group the relative mean difference is 0·69. There were 2,625,000 incomes greater than £500 and for this group the relative mean difference is 0·72. Thus the relative mean difference changes with the group with which we are concerned. It is practically the same for the 1947–48 incomes from £500 as it is for the whole range from £120.

5. We can compare these figures with some figures obtained from F. A. Cockfield's article in *Economica*, November, 1947, on "The Distribution of Incomes". Mr. Cockfield estimates the distribution for 1944–45 from £110, the total number of incomes being 18,625,000 and the aggregate income, £5,643 mn. The detailed distribution is not reproduced here; it is on p. 277 of the quoted number of *Economica*. For these data the relative mean differences

for different groups with various lowest incomes are:—

Income	£110	£135	£200	£300	£400	£500
Relative Mean Difference	0·79	0·79	0·78	0·77	0·77	0·76

Thus the whole 18,625,000 incomes from £110 upwards have a relative mean difference of 0·79, the 17,795,000 incomes from £135 upwards have a relative mean difference of 0·79, and so on. Since this period, 1944–45, the relative mean difference has declined quite appreciably.

6. We can also extend our information relative to the pre-war period. In the article quoted, Mr. Cockfield concerns himself with the distribution for 1937–38, which is given in the Inland Revenue Report for the year ending March 31st, 1940 (Cmd. 6769, March, 1946). This gives details of the distribution of 4,112,938 incomes, aggregating £1,989,520,000. This accounts for about 1,113,000 more incomes than were shown in the white paper data (for 1938) given in Table III. The starting income now is £200, while previously it was £250. The relative mean difference for the whole group from £200 is 0·90 and for the group from £250 (there are 2,556,711 in this group compared with the 3,000,000 incomes greater than £250 in 1938 in Table III) the relative mean difference is 0·93. These figures may be compared with 0·88 which we obtained for the distribution of the 3 million incomes greater than £250 in 1938.

7. Finally, T. Barna, in *Redistribution of Incomes Through Public Finance in 1937* (Oxford, 1945), p. 64, gives a table showing the estimated distribution of incomes in 1937 from £125. The number of incomes is 10 million and the aggregate income £2,965 mn. Computing the relative mean difference from these data we have the following results for a number of groups with different lowest incomes:—

Lowest Income ..	£125	£150	£175	£200	£250
Relative Mean Difference	0·85	0·87	0·89	0·92	0·95

Dr. Barna's 1937 figures for £200 and £250, 0·92 and 0·95 respectively, may be compared with the corresponding figures for 1937–38, first quoted, 0·90 and 0·93, and with the 1938 figure for £250, 0·88. Thus it appears that changes in the relative mean difference were taking place in the interval between 1937 and 1938: a lowering of a figure for £250 from 0·95 to 0·88 is noticeable. But we must point out that Barna's table estimates 2,650,000 incomes greater than £250 against the estimate of 3,000,000 in 1938. The change in the relative mean difference from 1937 to 1938 for a comparable group of 3 million is from 0·94 to 0·88.

The most complete data of those considered here are Barna's 1937 data (10 million), Cockfield's 1944–45 data (18,625,000) and the Inland Revenue data for 1947–48 (21 million). The relative mean difference for the whole of Barna's data from £125 upwards in 1937 is 0·85; this may be compared with 0·78 from Cockfield's 1944–45 data, and with 0·67 from the Inland Revenue data for 1947–48; in each case there are about 10,000,000 incomes. In 10 years the relative mean difference for a comparable large group of incomes has declined by about 20 per cent. There is less relative variability now than before the war.

8. It is natural that we should enquire about the variation in a group of incomes after tax has been deducted. In the Inland Revenue Report for the year ended March, 1948 (Cmd. 7738, July, 1949), already referred to, there is given a table classifying net incomes (after payment of Income Tax and Surtax). This table gives the frequency distribution but does not include figures of amounts of income. We can, however, estimate these latter figures.

TABLE V.

Net Incomes (after Tax), 1947–48.

Range of Net Income (£)	*Number of Incomes*	*Estimated Means* (£)	*Estimated Amounts of Income* (£mn)
120–150	2,030,000	135	274
150–250	8,470,000	195	1,652
250–500	8,740,000	325	2,841
500–1,000	1,378,000	655	904
1,000–2,000	320,000	1,320	422
2,000–4,000	58,500	2,625	154
4,000–6,000	3,430	4,400	15
6,000 and over	70	7,000	0
TOTAL ..	21,000,000		6,262

The total income of the 21 million in 1947–48 was given previously (Table IV) as £7,525 mn before tax.

In Table V, the figures of numbers of incomes in the various ranges are taken from the Report. The frequency curve appears to have a mode somewhere in the range £150–£250. It has been assumed that the total amount of income of the 2,030,000 incomes between £120 and £150 can be obtained by multiplying this number by £135, half-way between £120 and £150. For the incomes above £250, it appears that in the various ranges the distributions may be described by Pareto curves. From the appropriate computations we can estimate the average incomes of the various groups in the ranges. Thus, we estimate that the 1,378,000 incomes in the range £500 to £1,000 have an average at £655, the mid-value of the range being £750. From these averages, we can estimate the amounts of income contributed by each frequency to the total income of the whole. In the range £150—£250, where the distribution does not appear to be of the Pareto form, we have estimated the average as £195 instead of £200, the mid-value. Great accuracy is not claimed for these figures, but they are probably near the truth and from them we can get an estimate of the relative mean difference. The difference between the total income before tax and after tax (£1,263 mn) is of the right order of magnitude.

Using the figures in Table V, we find that the relative mean difference is 0·58. From the corresponding figures of Table IV, for the distribution before tax, we found the relative mean difference was 0·73. Thus the effect of taxation is to reduce the relative mean difference by about 20 per cent. For the 18,970,000 incomes greater than £150 after tax (omitting the first group) the relative mean difference is 0·55. For 7,000,000 incomes greater than £293 after tax, in 1947–48, the relative mean difference is 0·50. This last figure has been computed in order to make a comparison with certain pre-war figures.

9. In the white paper on National Income and Expenditure of the United Kingdom, 1938 to 1946 (Cmd. 7099, April, 1947), a table is given showing the distribution of net incomes in 1938–39. The lowest income is £150 and the number of incomes 7,000,000. Again, figures of amounts of income are not included in this table, but we have made estimates based on the assumption that, in the various income ranges, the distributions can be approximated by Pareto curves, and in this way obtain reasonable estimates of the average incomes of the various groups.

TABLE VI.

Distribution of net income in 1938–39.

Range of Income (£)	*Number of Incomes* (000)	*Estimated Means* (£)	*Estimated Amounts of Income* (£*mn*)
150–250	4,500	187.5	844
250–500	1,820	335	610
500–1,000	450	675	304
1,000–2,000	155	1,350	209
2,000–4,000	56	2,700	151
4,000–6,000	12	4,500	54
6,000 and over	7	8,500	59
TOTAL ..	7,000		2,231

The same reservations apply to these estimates as to those in Table V. It is hoped that we have got sufficiently near the truth to enable us to get a reasonable estimate of the relative mean difference. This figure is 0·74. Barna's distribution for 1937, already quoted, was concerned with about 7,600,000 incomes greater than £150 for which the relative mean difference was 0·87. Thus the effect of tax was to reduce the relative mean difference by about 15 per cent. in the pre-war period.

In 1938–39 there were 7 million incomes greater than £150, in 1947–48 there were 18,970,000 incomes greater than £150, both after tax. In 1938–39, the relative mean difference was 0·74, in 1947–48 it was 0·55, a decline of about 26 per cent. But perhaps we should compare the 7 million incomes after tax, in 1938–39, with the same number in 1947–48. We find that, in 1947–48, there were approximately 7 million incomes greater than £293 after tax. The relative mean difference of this group is 0·50. The change in the relative mean difference of these comparable groups is from 0·74 to 0·50, a decline of about 34 per cent.

We saw that, compared with pre-war, the relative mean difference of a comparable group of incomes before tax had declined by about 20 per cent. Now we find that a similar comparison for a group of incomes after tax shows a decline in the relative mean difference of about 34 per cent.

NOTES

(1) *Fitting* $n = Ax^{-\alpha} + Bx^{-\beta}$ *to data.*

Where we are given data showing cumulated frequences for values of x in geometric progression, such as 250, 500, 1,000, 2,000, as we are in the present instance, we can proceed as follows:

$$\text{If } n_1 = Ax^{-\alpha} + Bx^{-\beta},\ n_2 = A(\lambda x)^{-\alpha} + B(\lambda x)^{-\beta},$$
$$n_3 = A(\lambda^2 x)^{-\alpha} + B(\lambda^2 x)^{-\beta}$$
$$\text{we have } n_1 - \lambda^{\alpha} n_2 = Bx^{-\beta}(1 - \lambda^{\alpha-\beta})$$
$$n_2 - \lambda^{\alpha} n_3 = B\lambda^{-\beta} x^{-\beta}(1 - \lambda^{\alpha-\beta}).$$

Thus $n_1 - n_2(\lambda^{\alpha} + \lambda^{\beta}) + n_3 \lambda^{\alpha+\beta} = 0$.

Similarly if $n_4 = A(\lambda^3 x)^{-\alpha} + B(\lambda^3 x)^{-\beta}$,
$$n_2 - n_3(\lambda^{\alpha} + \lambda^{\beta}) + n_4 \lambda^{\alpha+\beta} = 0.$$

From these two equations involving n_1, n_2, n_3, n_4 we can compute λ^{α}, λ^{β}. The data for 1947 give us values of n for $x = 250$, 500, 1,000, 2,000 and 10,000. If we use the first form values of n and take $\lambda = 2$, we can then compute α and β. Substitution of these values in the equation $n_1 - \lambda^{\alpha} n_2 = Bx^{-\beta}(1 - \lambda^{\alpha-\beta})$ will give B. The equation $n_1 = Ax^{-\beta} + Bx^{-\beta}$ will then give A. Alternatively we could use the equation, $z = \frac{A\alpha}{\alpha - 1} x^{-\alpha+1} + \frac{B\beta}{\beta - 1} x^{-\beta+1}$, instead of the equation for n. In our computations, we used the z data rather than the n data because we thought that there might be less relative error in some of the original data for the z's than for the n's. In the original data, the figures for n appear to have been rounded off to the nearest 5,000, thus the n for $x = 2,000$, in the original data given as 175,000, may be in error by about 1½ per cent. The corresponding figure for z, 781 mn, presumably rounded off to the nearest million, may involve an error of less than 0·1 per cent.

(2) *Fitting $n = Ax^{-\alpha}$ to data.*

Where a single Pareto curve seems to be appropriate for given data, since $z = \frac{A\alpha}{\alpha - 1} x^{-\alpha+1}$, the ratio $\frac{z}{nx} = \frac{\alpha}{\alpha - 1}$. Thus, for given data, we can compute these ratios z/nx for the different x's, and where these appear to be practically the same, we can get α from the average of such ratios. From the n's and z's for the given x's, we can obtain estimates of log A, and average these to give the final figure. This method was adopted for the data for 1938, omitting the original values of n and z for $x = 10,000$, as the relative errors in these values would probably be much greater than for the other given data.

(3) *Computing the mean difference.*

Where the frequency distribution is $y=f(x)$, and

$$n=\int_x^b f(x)\,dx,\quad z=\int_x^b f(x)x\,dx,\quad N=\int_a^b f(x)\,dx,\quad Z=\int_a^b f(x)\,x\,dx,$$

the values of x ranging from a to b, we can write

$$\frac{dn}{dx}=-y.\quad \frac{dz}{dx}=-yx.$$

N is the total frequency, Z is the aggregate amount of the variable, $Z/N=\bar{x}$, the mean.

$$\frac{N^2}{2}\times\text{mean difference}=\int_a^b y\,dx\int_x^b y\,dx^1\,(x^1-x)$$

$$=\int_a^b y\,dx\,(z-nx)=\int_0^N z\,dn-\int_0^Z n\,dz.$$

For the single Pareto curve, $n=Ax^{-\alpha}$, $z=\dfrac{A\alpha}{\alpha-1}x^{-\alpha+1}$ where x ranges from x_0 to ∞,

$$\text{the mean difference}=\frac{2x_0\alpha}{(\alpha-1)(2\alpha-1)}=\frac{2\bar{x}}{2\alpha-1}.\quad\left(\bar{x}=\frac{x_0\alpha}{\alpha-1}\right)$$

Thus mean difference $/\bar{x}=2/2\alpha-1$.

The mean difference for the 1938 data has been computed from this formula.

For the distribution $n=Ax^{-\alpha}+Bx^{-\beta}$, $z=\dfrac{A\alpha x^{-\alpha+1}}{\alpha-1}+\dfrac{B\beta}{\beta-1}x^{-\beta+1}$, x ranging from x_0 to ∞, let us say $n=n_1+n_2$, $z=z_1+z_2$ and $N=N_1+N_2$, $Z=Z_1+Z_2$; then the mean difference is obtained from $\dfrac{N^2}{2}\times$ mean

$$\text{difference}=\frac{N_1Z_1}{2\alpha-1}+\frac{N_2Z_2}{2\beta-1}+\frac{N_1Z_2\alpha}{\beta(\alpha+\beta-1)}+\frac{N_2Z_1\beta}{\alpha(\alpha+\beta-1)}.$$

The values of the mean difference for 1947 for the various values of x_0 have been computed from this formula.

When we wish to compute the mean difference, without using a mathematical formula which describes adequately the whole data throughout the full range of values of x, we can proceed differently. When we are given data for n and z for the various values of x, typical data being n_r, z_r for x_r, we write :—

$$\frac{N^2}{2} \times \text{mean difference} = \int_0^N z\,dn - \int_0^Z n\,dz$$

$$= \sum_{r=0}^{r=m} \left(\int_{n_r}^{n_r+1} z\,dn - \int_{z_r}^{z_r+1} n\,dz \right)$$

when r takes values 0 , 1, 2, . . . m, and where $x_0 = b$, $x_m = a$; $n_0 = 0$, $n_m = N$; $z_0 = 0$, $z_m = Z$.

If we assume that $n = cz + d$ or $z = en + f$ for values of n and z in the ranges n_r to n_{r+1} and z_r to z_{r+1}, i.e., if we assume linear connections between n and z in these ranges, i.e., if we assume that the Lorenz curve connecting n and z can be replaced by a polygon, then

$$\int_{n_r}^{n_r+1} z\,dn - \int_{z_r}^{z_r+1} n\,dz = n_{r+1} z_r - n_r z_{r+1}.$$

Thus as a first approximation we have

$$\frac{N^2}{2} \times \text{mean difference} = \sum_{r=0}^{m} (n_{r+1}\, z_r - n_r\, z_{r+1}).$$

This formula will underestimate the mean difference, and the closeness of the approximation depends on the number of pairs of values of z, n in our data, i.e., on the degree to which the polygon is adequately describing the Lorenz curve. This formula has not been used in our computations except as a check.

If we assume that the arc of the Lorenz curve lying between the points on the curve given by (z_r, n_r) and (z_{r+1}, n_{r+1}) may be approximated by the formula

$z = Cn^{1-\frac{1}{a}}$ or $n = Kz^{\frac{a}{a-1}}$, where C and K are constants, either of these formulæ being obtained from the assumption that a single Pareto curve will describe the distribution in the short range of x, we get a better approximation.

Now, $$\int_{n_r}^{n_r+1} z\,dn - \int_{z_r}^{z_r+1} n\,dz = \left(\frac{Cn^{2-\frac{1}{a}}}{2-\frac{1}{a}} \right)_{n_r}^{n_r+1} - \left(\frac{Kz^{2+\frac{1}{a-1}}}{2+\frac{1}{a-1}} \right)_{z_r}^{z_r+1}$$

$$= \left(\frac{nz\alpha}{2\alpha-1}\right)_{n_r,\, z_r}^{n_{r+1},\, z_{r+1}} - \left(\frac{nz(\alpha-1)}{2\alpha-1}\right)_{n_r,\, z_r}^{n_{r+1},\, z_{r+1}} = \frac{n_{r+1}z_{r+1}-n_rz_r}{2\alpha-1}.$$

Thus $\frac{N^2}{2}$ × mean difference $= \sum_{r=0}^{m}\left(\frac{n_{r+1}z_{r+1}-n_rz_r}{2\alpha-1}\right)$.

If a single Pareto curve describes the whole data, then this gives $\frac{N^2}{2}$ × mean difference $= \frac{NZ}{2\alpha-1}$ and agrees with a previous result.

This formula can be used for given data of pairs of values of n and z, when we have estimated the appropriate α's for the various ranges of values of x, assuming Pareto curves. This formula in the form :—

$$\text{Mean difference } /\bar{x} = \frac{2}{NZ}\sum_{r=0}^{m}\left(\frac{n_{r+1}z_{r+1}-n_rz_r}{2\alpha-1}\right)$$

has been used for the computed relative mean differences for the data where no attempt has been made to find a mathematical formula to describe them.

When the α's have been computed from the data, we have assumed $\log z = \log C + \left(1-\frac{1}{\alpha}\right)\log n$ and obtained α from

$$\left(1-\frac{1}{\alpha}\right) = \frac{\log z_{r+1} - \log z_r}{\log n_{r+1} - \log n_r}.$$

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Revealed Preference and the Utility Function

By H. S. Houthakker

Professor Samuelson's "revealed preference" approach[1] has proved to be a useful basis for deriving a considerable part of the static theory of consumer's choice. Its existing versions are not sufficient, however, to determine whether or not consumer's preferences can be described by a utility function of the customary type (the problem of integrability),[2] except in the unrealistic case of two commodities. In this note Samuelson's "fundamental hypothesis" will be generalised so as to imply integrability while continuing to satisfy the methodological requirements of the revealed preference approach and without losing its plausibility. An attempt will be made to stress the logical, as distinct from the technically mathematical, aspects of the subtle problem of integrability, and to assess its importance.

It may be convenient to start with a brief discussion of the revealed preference approach. Though originally intended "to develop the theory of consumer's behaviour freed from any vestigial traces of the utility concept",[3] i.e., as a substitute for the "utility function" and related formulations, it has since tended to become complementary to the latter; in his *Foundations* Professor Samuelson uses it to express the empirical meaning of utility analysis, to which he apparently no longer objects.

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[1] P. A. Samuelson, "A Note on the Pure Theory of Consumer's Behaviour", *Economica*, 1938, pp. 61–71, 353–354; "The Empirical Implications of Utility Analysis", *Econometrica*, 1938, pp. 344–356; *Foundations of Economic Analysis* (Cambridge, Mass., 1947), Ch. V-VI; "Consumption Theory in Terms of Revealed Preference", *Economica*, 1948, pp. 243–253. Cf. also I. M. D. Little, "A Reformulation of the Theory of Consumer's Behaviour", *Oxford Economic Papers*, 1949, No. 1, pp. 90–99.

[2] Samuelson, *Foundations*, p. 111, note 14. For integrability in general, cf. R. G. D. Allen, *Mathematical Analysis for Economists* (London, 1938), pp. 422–423, 513–517; H. T. Davis, *The Theory of Econometrics* (Bloomington, Ind., 1947), pp. 77–81.

[3] Samuelson, "Pure Theory", *Economica*, 1938, p. 71.

Its fundamental concept is the relation which exists between a batch of goods X^a, bought by a consumer at prices P^a and income P^aX^a, and another batch X^b that might have been bought at the same income P^aX^a and prices P^a, its cost P^aX^b being smaller than or equal to this income, but was not in fact bought. This relation is described by the formula $P^aX^b \leqq P^aX^a$ and may be interpreted to mean that the consumer prefers X^a to X^b. Hence, by this comparison of value sums, X^b is "revealed to be inferior to" X^a, and X^a is "revealed to be superior to" X^b. The expressions between quotation marks, the first of which is fundamental, can be described under the name "revealed preference". In order to erect a theory on the basis of this relation a rule must be introduced for drawing conclusions from it. For this purpose Professor Samuelson remarks that if the inequality stated really reveals the inferiority of X^b to X^a, then X^a must not also be revealed to be inferior to X^b, as would be the case if $P^bX^a \leqq P^bX^b$. Therefore, $P^aX^b \leqq P^aX^a$ must imply $P^bX^b < P^bX^a$; this also means that at the income and prices at which X^b is bought, X^a must be too expensive, else it would have been bought instead. In the terminology of formal logic this implication (Samuelson's "fundamental hypothesis") declares revealed preference to be "asymmetric"; it will be further discussed below.

Another characteristic of this approach which should be noticed is the preponderant use of finite differences; it is felt that differential expressions should be avoided because they do not directly correspond to real phenomena.[1] This, together with the use of value sums, makes for a formulation of consumption theory in immediately observable quantities.

In what follows individual prices will be designated by p_i^t and quantities of goods by x_i^t; subscripts refer to the kind of good and superscripts to the price-income situation. For briefness the subscripts will be dropped whenever possible, price-sets being denoted by P^t and goods-combinations by X^t; value sums obtained by pricing a batch of goods will be written $P^sX^t = \sum_i p_i^s x_i^t$. The number of different goods (called n) is arbitrary. Two price-sets or batches of goods will be said to be different if at least one of the components p_i (or x_i) is different in them.

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[1] Samuelson, *Foundations*, p. 46.

In this notation a batch X^b is revealed to be inferior to another batch X^a if $P^aX^b \leqq P^aX^a$, and Samuelson's "fundamental hypothesis"[1] which states that the relation of revealed preference is asymmetric, reads:

If $X^a \neq X^b$ *and* $P^aX^b \leqq P^aX^a$, *then* $P^bX^b < P^bX^a$

It may be remarked that the use of this axiom implicitly assumes that to each batch X^t corresponds at least one price-set P^t; it can therefore be valid only in the "optimum region"[2] the class of all goods-combinations which are bought in *some* price-income situation. It need not be supposed (nor can it be deduced from the axiom) that there is only one price-set corresponding to each batch in the optimum region; this subject will require more attention as we proceed.

The main object of our investigation is to find a proposition which, apart from continuity assumptions, summarises the entire theory of the standard case of consumer's behaviour (no indivisible goods or choices between probabilities; all income spent). Such a proposition should imply and be derivable from utility analysis; in other words, it should be a necessary and sufficient condition for the existence of ordinal utility. Samuelson's hypothesis does not satisfy this criterion, being only a necessary condition and not a sufficient one, for although it can be derived from utility considerations it does not entail integrability, which is an essential property of utility functions. Consequently it is not "the ultimate generalisation of the law of demand".[3]

The reason for this deficiency appears to be that Samuelson's hypothesis relates only to two price-sets and, unlike utility analysis, throws no light on cases of three or more price-sets, except under special conditions. If we know, e.g., that $P^aX^b \leqq P^aX^a$ and that $P^bX^c \leqq P^bX^b$, we still cannot determine whether $P^cX^a \lesseqgtr P^cX^c$; this means that if X^b is revealed to be inferior to X^a and X^c is revealed to be inferior to X^b, then the hypothesis does not rule out the possibility that X^a is revealed to be inferior to X^c. This paradox, which is borne out by numerical examples, proves that Samuelson's hypothesis does not tell everything about revealed preference.

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[1] *Foundations*, pp. 110, 116.

[2] H. Wold, "A Synthesis of Pure Demand Analysis II", *Skandinavisk Aktuarietidskrift*, 1943, pp. 227–228. To this penetrating exposition the present note owes much.

[3] J. R. Hicks, *Value and Capital* (2nd edition, Oxford, 1946), p. 51. This quotation refers to a proposition still more restricted than Samuelson's hypothesis.

The general proposition we are looking for should prevent such anomalies; this can be achieved as follows. We consider a sequence of batches of goods X^t ($t = 0, 1, 2, \ldots T$; T arbitrary but finite) each of which is bought at prices P^t and an income P^tX^t. First we assume that each batch X^t is different from and revealed to be inferior to its predecessor in the sequence X^{t-1}. The sequence is then described by the formula $P^{t-1} X^t \leqq P^{t-1} X^{t-1}$; t now runs from 1 to T. If a utility function exists, and the utility of X^t is called $U(X^t)$, then the revealed inferiority we assumed implies that $U(X^0) > U(X^1) > U(X^2) > \ldots > U(X^T)$; consequently X^0 is superior to X^T. We cannot demand that in these circumstances X^T must be revealed to be inferior to X^0, for a batch may be inferior to another batch without being "revealed to be inferior"; but our axiom should exclude the case that X^0 is revealed to be inferior to X^T. It must therefore state that for the sequence under consideration $P^TX^T < P^TX^0$, for otherwise we should find $U(X^0) < U(X^T)$.

A further generalisation is possible and useful for later developments. We postulated that two successive commodity-combinations in the sequence are always different, but this condition may be weakened; it is sufficient that there is at least one pair of successive and different batches. To explain this we suppose that X^s and X^t are identical; then it is evidently true that $P^tX^s \leqq P^tX^t$, and the statement $U(X^s) \leqq U(X^t)$ is equally unobjectionable and uninformative. Now, as an example, in the sequence previously considered we take $T = 3$ and we assume that X^1 and X^2 are different, whereas the other successive batches may or may not be different; as before, the formula $P^{t-1}X^t \leqq P^{t-1}X^{t-1}$ holds throughout. Then utility analysis tells us that $U(X^0) \geqq U(X^1) > U(X^2) \geqq U(X^3)$ so that X^3 is still inferior to X^0. It is clear that this example is of general application; consequently the axiom should still state, as required above, that X^0 is not revealed to be inferior to X^3. We can even improve on the condition that there exists at least one pair of successive different batches, for if we know that any two batches in the sequence are different, then there must necessarily be somewhere a batch which differs from its predecessor.

To sum up, the new axiom reads:

> *If* $X^0, X^1, X^2 \ldots X^T$ *is a sequence of batches of goods such that each batch is bought at prices* $P^0, P^1, P^2 \ldots P^T$ *respectively, and if at least two of these batches are different, and if the cost* $P^{t-1}X^t$ *of each batch* X^t *at prices* P^{t-1} *is not greater than the cost* $P^{t-1}X^{t-1}$ *of the preceding batch in the sequence* X^{t-1} *at the same prices, then the cost* P^TX^T *of the last batch* X^T *at prices* P^T *is less than the cost* P^TX^0 *of the first batch* X^0 *at the same prices.*

or more shortly:

> *If for every finite t and T* $(t = 1, 2, \ldots, T)$ *the inequality* $P^{t-1}X^t \leqq P^{t-1}X^{t-1}$ *holds, and if there are numbers i and j such that* $0 \leqq i < j \leqq T$ *and* $X^i \neq X^j$, *then* $P^TX^T < P^TX^0$.

As to the significance of this axiom, like Samuelson's "fundamental hypothesis" it serves to substantiate the revealed preference relation, but in a more exhaustive way. The revealed preference relation, it will be remembered, exists between a batch X^a actually bought and another batch X^b which might have been bought but was not (for a given price-income situation); this was interpreted to mean that X^b is inferior to X^a. Now Samuelson's hypothesis states that this interpretation is not contradicted if X^b is actually bought (in another price-income situation), for then X^a must be too expensive. The extended axiom says essentially the same, but it also takes into account information provided by intermediate revealed preferences.

From a logical point of view it will be noticed that the above axiom is a statement about the relation between the first and last elements of a chain when something is known about the intermediate links in the chain. The property of the relation of revealed preference it postulates is therefore akin to transitivity, though weaker than transitivity itself; it might be called "semi-transitivity".[1] This is not the place for an investigation of the difference between transitivity and semi-transitivity, but it may be in order to point out that a transitivity postulate need involve only three elements, while the above axiom involves $T+1$ elements, where T is any finite number.

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[1] Compare the concept of "acyclicity" discussed by J. von Neumann and O. Morgenstern, *Theory of Games and Economic Behaviour* (2nd edition, Princeton, 1947), p. 591 ff. Cf. also Samuelson, *Foundations*, pp. 151–152.

We have now seen that the new axiom is a necessary condition for the existence of ordinal utility; our next task is to prove that it is also a sufficient condition; i.e., we must reconstruct the concept of ordinal utility on the basis of the semi-transitivity of revealed preference.

To begin with, Samuelson's hypothesis will be derived as a theorem. This is extremely simple, for we need only take $T = 1$ to find that if $X^0 \neq X^1$, then $P^0X^1 = P^0X^0$ implies $P^1X^1 < P^1X^0$. Because of this theorem several well-known results become available at once. Two properties in particular will be needed[1]: that each set of prices and income uniquely determines one collection of goods bought, and that quantities bought remain the same if all prices and income change in the same proportion.

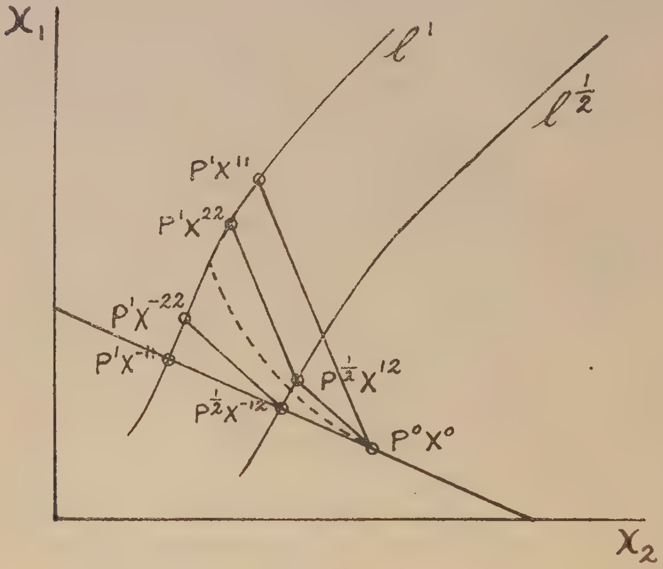

FIG. 1.

l^1 is the locus of all batches bought at prices P^1 for varying income; similarly for $l^{\frac{1}{2}}$. The straight line through P^0X^0 and P^1X^{-11} has a slope P^0; the lines going to the south-east from P^1X^{11} and P^1X^{22} have a slope P^1; and those going to the south-east from $P^{\frac{1}{2}}X^{12}$ and from P^1X^{-22} have a slope $P^{\frac{1}{2}}$. The dotted curve is the limiting line.

The proposed construction of indifference surfaces (i.e., of ordinal utility) will be carried out by a method the outlines of which were first suggested in the *Foundations* (pages

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[1] Samuelson, *Foundations*, pp. 111–112.

147–153) and which has since been considered in more detail by Mr. Little (*loc. cit.*) and by Professor Samuelson himself (*Economica*, 1948), though only for the case of two goods. I shall restate this procedure in somewhat different terms and without restricting the number of goods. The exposition will deal with a gradually extended sequence of price-sets, to be defined later on. As a preliminary a convention will be introduced in order to avoid irrelevant complications due to mutually proportional price-sets (in view of the homogeneity of demand-functions): in each price-set P^t one of the individual prices, viz., p_1^t, will be put equal to unity. Furthermore, it will have to be assumed that demand-functions have continuous derivatives with respect to prices and income.

After these preparations we can start building up indifference-surfaces; in other words, we shall try to find all the batches "equivalent" to a given batch. (A two-dimensional illustration is given in Fig. 1. The argument depends neither on this graph nor on the following ones.) We consider a batch of goods X^0, which is bought at prices P^0, and a price-set P^1 at which X^0 is not bought.[1] The batch bought at prices P^1 and income P^1X^0 will be called X^{11}; this batch is obviously different from X^0 and it is also revealed to be superior to it, as $P^1X^{11} = P^1X^0$. We shall regard P^1 as an element in a sequence of price-sets which will be increased to infinity by the following procedure. Between P^0 and P^1 we take an "intermediate" price-set $P^{\frac{1}{2}}$, by which is meant a price-set whose components satisfy the condition:

$$p_i^{\frac{1}{2}} = \tfrac{1}{2}(p_i^0 + p_i^1)$$
$$(i = 2, 3, \ldots, n)$$

The collection of goods X^{12} which is bought at prices $P^{\frac{1}{2}}$ and income $P^{\frac{1}{2}}X^{12} = P^{\frac{1}{2}}X^0$, is either equal to X^0 (a case we cannot exclude) or revealed to be superior to it. We also define a batch X^{22}, bought at prices P^1 and income $P^1X^{22} = P^1X^{12}$; this is either equal to X^{12} or revealed to be superior to it; but if X^{22} is identical with X^{12}, then X^{12}

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[1] This implies that P^0 and P^1 are different (for identical price-sets determine identical batches), but this condition is not enough, as different price-sets cannot be proven to determine different batches. The latter property is introduced by Samuelson (*Economica*, 1948, p. 273) as an extra assumption, but it unnecessarily impairs the significance of revealed preference theory, for Wold (*loc. cit.*, III, *Skandinavisk Aktuarietidskrift*, 1944, pp. 78–88) has shown that this assumption by itself implies the existence of ordinal utility, which would make revealed preference considerations superfluous. After the above was written Professor Samuelson informed me that he does not accept Wold's theorem.

is not identical with X^0, and vice versa, for we have postulated that X^0 is not bought at prices P^1 and so all batches bought at prices P^1 must be different from X^0.

We go on by taking a price-set $P^{\frac{1}{4}}$ intermediate between P^0 and $P^{\frac{1}{2}}$, which together with an income $P^{\frac{1}{4}}X^{14} = P^{\frac{1}{4}}X^0$ determines a batch X^{14} that is again either equal or revealed to be superior to its predecessor X^0. After having considered X^{24}, bought at prices $P^{\frac{1}{2}}$ and income $P^{\frac{1}{2}}X^{24} = P^{\frac{1}{2}}X^{14}$, we proceed to the price-set $P^{\frac{3}{4}}$, intermediate between $P^{\frac{1}{2}}$ and P^1. By now the process will have become clear; ever more intermediate price-sets are introduced and batches and incomes are determined accordingly. For every given number S of price-sets between P^0 and P^1 we obtain a sequence of incomes (called the *superior income-sequence* of length S) each of which determines a batch that is either equal or revealed to be superior to the batch determined by the preceding income; and the last batch thus determined (i.e., X^{SS}) is always different from the original batch X^0.

As counterparts to the superior income-sequences we shall construct *inferior income-sequences* for various lengths of S, which are also based on the sequence of price-sets we have just considered. The process of finding intermediate price-sets need not be repeated and we shall assume for simplicity that $S = 4$, which means that we shall fit an inferior income-sequence to the prices P^0, $P^{\frac{1}{4}}$, $P^{\frac{1}{2}}$, $P^{\frac{3}{4}}$ and P^1. As before, X^0 is taken as given, and X^{-14} is to be a price-set bought at prices $P^{\frac{1}{4}}$ and satisfying $P^0X^{-14} = P^0X^0$, i.e., X^{-14} is either equal or revealed to be inferior to X^0.[1] In the same way, $P^{\frac{1}{2}}X^{-24}$ is defined to determine a batch X^{-24} which at prices $P^{\frac{1}{4}}$ costs as much as X^{-14}, $P^{\frac{3}{4}}X^{-34}$ is implicitly described by the equation $P^{\frac{1}{2}}X^{-34} = P^{\frac{1}{2}}X^{-24}$, and the terminal element in this inferior income-sequence of length 4 is chosen to make true $P^{\frac{3}{4}}X^{-44} = P^{\frac{3}{4}}X^{-34}$.

Now we shall prove that for any finite S the superior terminal income P^1X^{SS} is higher than the inferior terminal income P^1X^{-SS}. For this purpose we shall observe a sequence of goods-batches which starts at X^{SS}, then proceeds along the superior income-sequence (but in the inverse direction) to X^0, and thence along the inferior income-sequence (in the original direction) to X^{-SS}. From the definitions of the two income-sequences it is clear that the formula $P^{t-1}X^{t} = P^{t-1}X^{t-1}$ holds throughout (i.e., each batch is either equal or revealed to be inferior to its predecessor), while X^{-SS} and X^{0} are known to be different (cf. above), so our axiom may be applied for $T = 2S$ and we see that $P^{1}X^{-SS} < P^{1}X^{SS}$.[1] It should be evident that this inequality is valid also for intermediate incomes (i.e., incomes belonging to intermediate price-sets), provided they determine batches different from X^{0}. Consequently for any finite S the incomes belonging to the superior income-sequence are all higher than their counterparts in the inferior income-sequence.

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[1] If there is more than one batch satisfying this condition we should take the one that gives the highest value of $P^{\frac{1}{4}}X^{-14}$.

What happens if S approaches infinity ? Because of the process by which intermediate price-sets were selected the differences between individual prices in succeeding price-sets become steadily smaller as the number of price-sets increases ; for the value of each newly-introduced individual price lies between the values of the two adjacent prices. In the limit prices will vary continuously between P^{0} and P^{1}.

To observe the consequences for the income-sequences we take an arbitrary intermediate price-set P^{a}, which will be kept fixed, and another intermediate price-set P^{b} which is varied as to the successor of P^{a} for any S ; we abandon the previous notation which has served its purpose. For the superior income-sequence we have by definition (whether X^{+a} and X^{+b} are different or not) $P^{b}X^{+b} = P^{b}X^{+a}$. If we denote $P^{b}X^{+b} - P^{a}X^{+a}$ by $\triangle M^{+}$, and $p_{i}^{b} - p_{i}^{a}$ by $\triangle p_{i}$, we can write $\triangle M^{+} = \sum_{i} x_{i}^{a} \triangle p_{i}$. If P^{b} approaches P^{a} indefinitely we can replace " $\triangle$ "s by " d "s (remembering the assumed differentiability) and put $dM^{+} = \sum_{i} x_{i}^{u} dp_{i}$. This is a differential equation for the " superior income-line ", the envelope of the superior income-sequence of length S when S tends to infinity.

According to the definition of the inferior income-sequence $P^{a}X^{-b} = P^{a}X^{-a}$, and therefore with an obvious extension of our notation, we write $\triangle M^{-} = \sum_{i} x_{i}^{b} \triangle p_{i} = \sum_{i} x_{i}^{a} \triangle p_{i} - \sum_{i} \triangle x_{i} \triangle p_{i}$. In the limit the last term becomes of the second order of smallness and may therefore be neglected (again remembering our continuity assumptions), so we obtain $dM^{-} = \sum_{i} x_{i}^{a} dp_{i}$ as the differential equation of the " inferior income-line ".

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[1] This theorem can also be derived from Samuelson's (unextended) hypothesis.

It will be noticed that the superior and inferior income-lines satisfy the same differential equation

$$dM - \sum_i x_i \frac{\partial p_i}{\partial t} dt = 0$$

where x_i is a function of prices and income, while prices are constrained by belonging to the price-sequence described. Therefore prices can be represented as functions of one parameter t, and the differential equation itself contains only two variables. The point X^0 is known to satisfy this equation, which gives M as a function of t (i.e., of prices) if the so-called Lipschitz conditions[1] are fulfilled :

$$\left| \sum_i x_i(t, M^1) - \sum_i x_i(t, M^2) \right| < K \left| M^1 - M^2 \right|$$

where M^1 and M^2 are any two possible values of M for given prices and K is a constant. Clearly these conditions follow from our continuity assumptions. Therefore the differential equation defines just one curve, which means that the superior and inferior income-lines coincide.

Having found that the superior and inferior income-sequences have one common limit, which can be approached as closely as wanted by taking a sufficient number of intermediate price-sets, we must now consider the incomes belonging to this limit. To every price-set between and including P^0 and P^1 there is precisely one such income, which belongs neither to a superior nor to an inferior income-sequence of any finite length. It is therefore the only income (for a given price-set) to determine a batch about which no direct or indirect indications as to its inferiority or superiority with respect to X^0 are available.[2] Does this mean that this batch is " equivalent " to X^0 ? No doubt this is a reasonable guess, but in connection with the elusive problem of integrability nothing should be taken for granted. We shall find, in fact, that at this stage of our analysis Samuelson's hypothesis is no longer adequate and our axiom of semi-transitivity must be invoked.

Since P^1 was chosen arbitrarily (except for the condition that X^0 is not bought at these prices) we may now allow it to vary among all price-sets satisfying the latter condition.

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[1] Cf. E. L. Ince, *Ordinary Differential Equations* (New York, 1944), pp. 62–63.

[2] Incomes higher than those belonging to some superior income-sequence are evidently revealed to be superior to the latter. A similar remark can be made for the inferior income-sequence.

For each price-set we then have one income with the unique property mentioned above, which may less precisely be described to be that all higher incomes are connected with X^0 by a chain of goods-batches of descending superiority and all lower incomes by a chain of batches of ascending superiority. Now if this unique property is an equivalence between X^0 and the terminal batches thus determined, it must be reflexive (X^0 must be equivalent to itself), symmetric (if X^0 is equivalent to X^1, then X^1 is equivalent to X^0) and transitive (if X^0 is equivalent to X^1 and X^1 is equivalent to X^2, then X^0 is equivalent to X^2).[1] These characteristics of relations are indispensable for the construction of indifference surfaces, i.e., of classes of equivalent batches.

We shall start by proving that this presumed equivalence is symmetric, which is another consequence of the argument used previously to show that the superior and inferior income-sequences coincide in the limit. Let P^1X^1 be the income at prices P^1 which separates the inferior and superior income-sequences of ever-increasing length which start at X^0; then X^1 is presumed to be equivalent to X^0. By a similar process P^0X^{00} has been found such that X^{00} is presumed to be equivalent to X^1. For presumed equivalence to be a symmetric relation X^0 and X^{00} must coincide, and that this is in fact true, can be seen as follows: The differential equation of the common limit (of superior and inferior income-sequences) between X^0 and X^1 is $dM = \sum_i x_i dp_i$, as we found above, but this equation also holds for the common limit between X^1 and X^{00}. Since the two limits coincide at X^1 they coincide everywhere, and so X^0 and X^{00} are identical.

Transitivity cannot be proved in this way, and here for the first time we must make full use of our axiom, which postulates the semi-transitivity of revealed preference. We suppose that, because of the construction described, X^1 is presumed to be equivalent to X^0, and X^2 is presumed to be equivalent to X^1. Furthermore, there is a direct link of this kind between X^{22} (also bought at prices P^2) and X^0.[2] If this presumed equivalence is transitive X^{22} and X^2 cannot be distinct, and this we shall proceed to prove. (cf. Fig. 2). Let us assume, in fact, that $P^2X^{22} > P^2X^2$

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[1] Cf. e.g., A. Tarski, *Introduction to Logic* (2nd edition, New York, 1946), p. 96 ff.

[2] X^2 is not bought at prices P^0 or P^1, and X^1 is not bought at prices P^0.

and that $P^2X^{22} - P^2X^2 = 4D$ (say). We know that, by selecting a suitable number of intermediate price-sets, we can make our inferior and superior income-sequences end as near as we wish to their common limit. Now we take a superior income-sequence starting at P^0X^0 and ending at an income $P^1X^1 + D$ (for prices P^1), and another superior income-sequence starting at $P^1X^1 + D$ and ending at

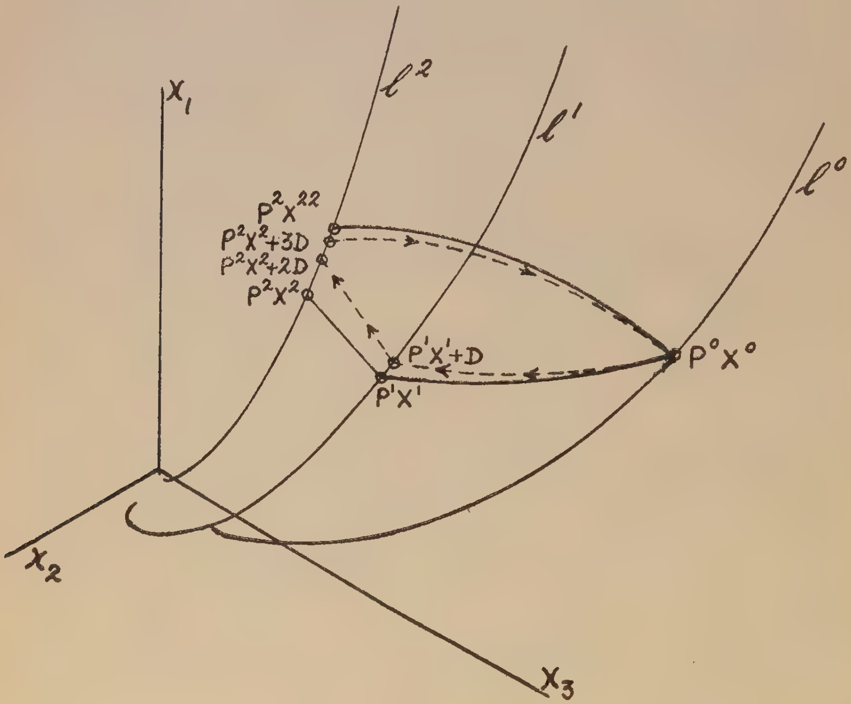

FIG. 2.

l^0, l^1 and l^2 have a similar meaning as in Fig. 1. The arrows on the dotted curve point from inferior to superior batches.

$P^2X^2 + 2D$, i.e., halfway between P^2X^2 and P^2X^{22}. We also construct an inferior income-sequence starting at P^0X^0 and ending at an amount D below P^2X^{22}, i.e., at $P^2X^2 + 3D$. Then we apply the axiom of semi-transitivity to the whole of the three sequences. We start at $P^2X^2 + 2D$ and proceed to P^0X^0 (by way of $P^1X^1 + D$) along the originally superior income-sequences, which are now looked at in the inverse direction, so that each consecutive batch is either equal or revealed to be inferior to its predecessor.

From P^0X^0 we continue along the original inferior income-sequence (in the original direction) to $P^2X^{22} - D = P^2X^2 + 3D$.

If $P^2X^{22} > P^2X^2$ the above construction is always possible (and so is a similar one for the case $P^2X^{22} < P^2X^2$), but it leads to a contradiction of the axiom. For $P^2X^2 + 2D$ is linked to $P^2X^2 + 3D$ by a chain of batches of which each is equal or revealed to be inferior to its predecessor, and at least two of these batches are different,[1] and then the axiom tells us that the first income is higher than the last one. But $P^2X^2 + 2D < P^2X^2 + 3D$ (since $D > O$), so $P^2X^{22} > P^2X^2$ is not true. The reader will have no difficulty in applying this argument to $P^2X^{22} < P^2X^2$. Consequently $P^2X^{22} = P^2X^2$, and the relation of presumed equivalence is transitive.[2]

It remains to show that it is reflexive, i.e., that every batch is equivalent to itself. If we denote presumed equivalence by R, we have now demonstrated that X^0RX^1 implies X^1RX^0 (symmetry) and that X^0RX^1 and X^1RX^2 imply X^0RX^2. Our proof of transitivity can easily be extended to the case where X^0 and X^2 are identical which yields X^0RX^0.

These results enable us to drop the word presumed and simply speak of " equivalence ". It is true we have shown only that the relation defined by the limiting lines of ever longer inferior and superior income-sequences is an equivalence in the sense of formal logic, but previously we had remarked that it meant the absence of both superiority and inferiority. We also saw that to every price-set there is just one collection of goods equivalent to a fixed collection X^0. The class of all equivalent batches can be identified with the indifference surface through X^0. The existence of indifference surfaces implies the existence of a utility function, for to each class of equivalent batches we can assign a number (the " utility " of that class), giving higher numbers to preferred classes. As is well known, this can be done in infinitely many ways, since only ordinal properties are involved.

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[1] Because of the assumptions in note 2 on p. 169.

[2] In Pareto's language this means that a " cycle ouvert " is impossible. Cf. V. Pareto, *Manuel d'Economie Politique* (2nd edition, Paris, 1927, p. 556). This proof also shows that the method of selecting " intermediate " price-sets does not influence the result.

For the benefit of mathematicians it may be pointed out that this part of the proof amounts to showing that the line integral (of the difference in utility between equivalent batches) is zero along a closed curve and therefore independent of the path. This is a well-known integrability condition; cf. R. Courant, *Differential and Integral Calculus II* (London and Glasgow, 1936), p. 351.

Before turning to some more general questions it may be useful to point out why the problem of integrability does not arise in the case of two commodities, which was investigated by Mr. Little and Professor Samuelson (*loc. cit.*).

The process by which inferior and superior income-sequences were made to coincide in the limit (cf. above) consisted in allowing prices to vary continuously between two given price-sets P^a and P^b. We also introduced a convention, with a view to proportionality complications, by which the first price in every price-set was put equal to unity. If there are only two goods this implies that there is but one price (i.e., p_2) which is different between P^a and P^b, and there is but one way of changing it continuously between p_2^a and p_2^b in the way described. Consequently there can be no question of P^b being reached from P^a in more than one way, which means that there is no need to prove that " presumed equivalence " is transitive. Since, in the general case of n goods, this was the only place where our extended axiom was indispensable, no appeal to this axiom need be made if there are only two goods ; then Samuelson's original hypothesis is enough.

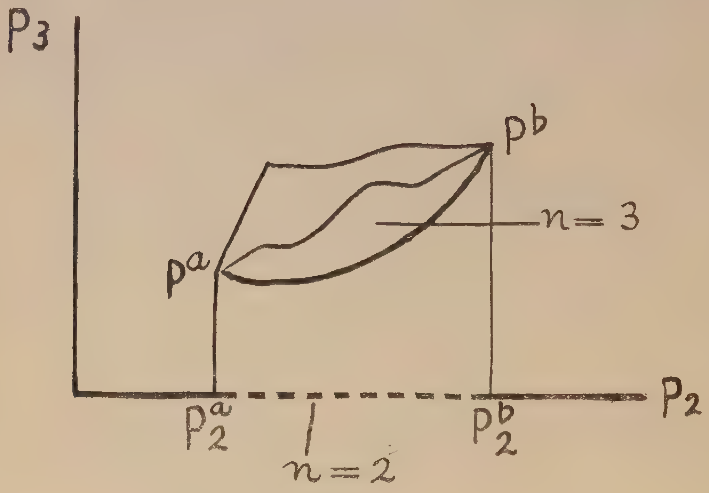

FIG. 3

If there are three or more goods, and therefore two or more varying prices, there are several paths from P^a or P^b, as can be seen from Fig. 3. If $n = 2$ the relevant price p_2 can change only along its axis, but if $n = 3$ there are two prices which can vary through the plane, and similarly if $n > 3$. Integrability means that the relation between two points does not depend on the path followed from the one to the other.

As a conclusion some comments on the significance of our results will be made.

We have shown that a theory based on semi-transitive revealed preference entails the existence of ordinal utility, while the property of semi-transitivity itself was derived from utility considerations. The "revealed preference" and "utility function" (or "indifference surface") approaches to the theory of consumer's behaviour are therefore formally the same.[1]

This solves the problem suggested by Professor Samuelson,[2] viz., to deduce integrability from a generalisation of his "fundamental hypothesis". He also required an expression for the integrability conditions in finite form, i.e., "conceivably refutable by a finite number of point observations",[3] instead of by statistically smoothed curves. Our axiom of semi-transitivity is precisely this; it is not a property of curves, but of relations between a finite number of batches. Nevertheless, the practical importance of integrability can more clearly be seen from the well-known Slutsky conditions:

$$x_i \frac{\partial x_i}{\partial M} + \frac{\partial x_i}{\partial p_j} = x_i \frac{\partial x_j}{\partial M} + \frac{\partial x_j}{\partial p_i}$$

a set of reciprocal relations between cross-derivatives of demand.

The difference between the unextended hypothesis and our generalisation is merely that the latter takes into account information provided by the choices at other prices than the two price-sets which figure in Samuelson's axiom. This suggests that the problem of integrability arises only because of an incomplete statement of assumptions; no real generality is lost by supposing revealed preference to be semi-transitive instead of only asymmetric. The reasons for assuming asymmetry are no different from those for assuming semi-transitivity, as can be seen from our motivation of the extended axiom.

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[1] The same result was proved by essentially analogous methods for the "marginal substitution" approach by Professor Wold, loc. cit., Part I, *Skandinavisk Aktuarietidskrift*, 1943, pp. 103–117.

[2] *Foundations*, p. 111, *n.* 19; p. 139, *n.* 17. Cf. also *Economica*, 1948, p. 251, *n.* 2.

[3] *Foundations*, p. 107, *n.* 13.

Integrability therefore appears to be essentially a spurious problem, a " will o' the wisp " as Professor Hicks has called it.[1] It might be used as a test for the completeness of any set of axioms for the static theory of consumer's behaviour, at least if saturation phenomena are excluded.[2]

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[1] *Value and Capital*, p. 19, note 1. This is borne out by the result mentioned in note 1 on previous page.

[2] The connection between non-integrability and saturation has been investigated by N. Georgescu-Roegen, " The Pure Theory of Consumer's Behaviour ", *Q.J.E.*, 1936, pp. 545–593.

Recent German Contributions to Economics

By Alan T. Peacock

I

Introduction

The intellectual isolation of Germany during the '30s and the late war has done much to cause us to neglect the contribution to our subject made by some of her economists. While we remember that many German economists have found their way to the New World and elsewhere and have made significant contributions to Economics, it might be easy to suspect those who remained in Germany as prominent writers under the Nazi regime. (There has been at least one unfortunate misunderstanding in this connection.[1]) There are two important writers who, whatever their political views, have kept their writings free of political dogma and both of them have produced some interesting work in recent years. It is my purpose in this paper to discuss two works,[2] both of which are of an expository character, but which contain a distillation of many original and stimulating ideas culled from the more severely academic writings of their authors. Furthermore, both works provide a convenient point of departure for the discussion of other aspects of their authors' work and of German writings which have influenced or have been influenced by them.

The theoretical interests of both Stackelberg and Schneider have interesting common features. Both economists are noted chiefly for their earlier contributions to price and production theory.[3] In contrast to many of their German

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[1] The case of Stackelberg's *Marktform und Gleichgewicht* which earned its author the reputation of being an apologist of Fascism. Cf., however, infra., p. 185.

[2] H. v. Stackelberg: *Grundlagen der theoretischen Volkswirtschaftslehre.* A. Francke A. G. Bern, 1949. Referred to in the text as the *Grundlagen.*

Erich Schneider: *Einführung in die Wirtschaftstheorie* (Teil I and II).

J. C. B. Mohr (Paul Siebeck) Tübingen, 1947 and 1949. Both works are being translated into English.

[3] Stackelberg: "Grundlagen einer reinen Kostentheorie" (*Zeitschrift der Nationalökonomie*, 1932) and *Marktform und Gleichgewicht*, Wien, 1934.

Schneider: *Reine Theorie monopolistischer Wirtschaftsformen*, Tübingen, 1932, and *Theorie der Produktion*, Wien, 1934. A bibliography, although not an exhaustive one, of the works contemporaries, their theoretical work has been influenced to a great extent by foreign writers. Stackelberg by the Austrian School, Pareto, and in later years Hicks and Schneider by Ragnar Frisch and the Swedish School. Both developed part of their work abroad, Schneider in Denmark and Stackelberg in Spain where he died in October, 1946, at the age of 41. But there the correspondence ends. Schneider's *Einführung* is a remarkable synthesis of modern economic theory embodying the use of social accounting as a pedagogic device and with a refined treatment of equilibrium analysis and we are to expect a final volume devoted to macro-economics in the near future. Stackelberg, perhaps less enthusiastic about modern developments abroad in macro-economics, has been much more concerned to develop the Austrian approach in such a way as to accord with modern partial and general equilibrium analysis associated with the indifference curve technique. (As we shall observe later, it is paradoxical that despite his veneration of Continental classical theory, his own particular contribution was the examination of market conditions in which equilibrium analysis did not appear to be helpful.) Furthermore, there are considerable differences in their respective treatments of problems of price theory, particularly in regard to duopoly and oligopoly analysis. Stackelberg has a good deal to say about problems of the economic order, while Schneider is silent on such matters.

The following sections are concerned with three aspects of their work. Section 2 considers some problems of methodology and pedagogy, Section 3 certain characteristics of their recent treatment of the oligopoly problem and Section 4 deals with Stackelberg's conception of the economic order.

II

Methodology and Pedagogy

It is recorded by Professor Pigou[1] that Marshall is reputed to have remarked that ' Germans when they write try to say

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of these writers on price theory is recorded in Chamberlin's *Theory of Monopolistic Competition*, Appendix to 6th Edition, 1949. For a complete bibliography of Stackelberg's writings together with a valuable account of his contribution to economic theory, see Hans Möller: "Heinrich, Freiherr v. Stackelberg und sein Beitrag für die Wirtschaftswissenschaft" (*Zeitschrift für die Gesamte Staatswissenschaft*. Heft 3, 1949).

[1] Preface to the *Memorials*, p. 86.

everything that is true, Englishmen everything that is true and important.' It is well known that this remark was particularly directed at the later German Historical School but it still expresses a common view of German economic thought. But there were a number of contemporaries of Schmoller and his entourage who did not indulge in what Menger contemptuously called 'historisch-statistisches Kleinmalerei', among them such writers as Launhardt, Zwiedeneck-Südenhorst and Auspitz and Lieben[1] to whose work Stackelberg and Schneider have paid some attention.

Despite this evidence of a German tradition in theoretical economics, we find both writers still having to defend their formal treatment of economic problems.[2] For instance, at the end of an important article on problems of imperfect competition, Stackelberg writes: "empirical investigation can gradually produce substantiation (of theoretical postulates) but it must always be equipped with the tools of modern theory if its results are to be crowned with success. We observe at this juncture how stupid is the yet unforgotten quarrel concerning the 'correct' method. Those who still maintain that historical and empirical methods of research should replace theoretical deduction are about as intelligent as those who assert that a rifle can be fired without bullets." It is therefore all the more interesting to observe how they have approached the problem of exposition.

It is becoming increasingly realised, especially in view of the development of macro-economics, that a useful introduction to theoretical analysis is afforded by a description of the various 'sectors' of the economy, first identifying them and then describing their inter-relationships. However justified Professor Knight's criticism of the "Wirtschaftskreislauf" as a picture of economic reality may be,[3] there is no doubt that it is extremely useful as a pedagogic device. Both the *Grundlagen* and the *Einführung* begin with such a description. Stackelberg, however, abides by the traditional dichotomy of 'producers' and 'households' in an extremely condensed but nevertheless illuminating description of the exchange economy in which the latter is compared to an intricate canal system where 'stocks' are held in the canal locks and 'flows' are represented by the volume of water in the canal system. This serves both to explain the relationships between the two sectors and to trace, perhaps all too briefly, the depressive and expansive effects of changes in the 'level' of stocks and the 'volume' of the flows.

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[1] See, for instance, Launhardt's *Mathematische Begründung der Volkswirtschaftslehre*, Leipzig, 1885, and references to it in Schneider's *Einführung*, p. 252, and Stackelberg's *Grundlagen*, p. 281. Launhardt, for instance, derives a 'backward sloping supply curve for labour' from an elaborate mathematical analysis. Zwiedeneck-Südenhorst is referred to below. Stackelberg appears to have been somewhat impressed by the elegance of the treatment of price theory by Auspitz and Lieben (see their elaborate use of total cost and total revenue curves in *Untersuchungen der Theorie des Preises*, Leipzig, 1889, and *Zur Theorie des Preises*, Leipzig, 1887).

[2] Schneider: *Das Gesicht der Wirtschaftstheorie unserer Zeit und das Studium der Wirtschaftswissenschaften*, J. C. B. Mohr, Tübingen, 1947, pp. 21–22.

Stackelberg: *Grundlagen*, pp. viii–ix, and "Probleme der unvollkommenen Konkurrenz" (Weltwirtschaftliches Archiv, 1938) from which the passage quoted above is taken.

[3] F. Knight: *Risk, Uncertainty and Profit.* Preface to the 1948 Reprint, p. xliv.

On the other hand, the arresting feature of Schneider's book is the development he makes of the Kreislauf approach beginning with the two sectors as a first approximation and gradually modifying the simple picture of the economy with the inclusion of the state, trade with other economies and credit institutions so that the way is made clear for a description of the whole process of income propagation. Part I of the *Einführung* is also characterised by a set of useful diagrams illustrating the propagation process which can easily be adapted for the study of National Income flows.[1]

Superficially at least, Schneider's treatment would appear to be a more extensive version of Stackelberg's second chapter of the *Grundlagen*. The respective aims are different, however, and these can easily be discerned in their conclusions to the Kreislauf analysis. Stackelberg is concerned to show the interdependence of both commodity and factor markets and of relative prices and sums up his analysis in terms of the 'exchange equation' of Irving Fisher. Schneider, however, uses his analysis to build up the Keynesian equation so as to link the first part of his exposition to his later analysis where the equation expresses casual relationships and is no longer merely a definitional concept.

For the rest, Stackelberg follows out the traditional procedure in partial equilibrium analysis, still, however, with some significant features in treatment. The theory of consumption is expounded elegantly by means of indifference curve analysis and it is made clear that the modern analysis is derived, of course, from Gossen's laws! There is a careful and necessary distinction made between the inter- and intra-temporal scale of wants. (Cf. Part III of the *Grundlagen.*) Secondly, there is the unmistakable development of his theory of price formation since the days of *Marktform und Gleichgewicht* where Stackelberg pays tribute to some of the empirical work done in Germany in recent years. Lastly, there is the final chapter on the 'workability' of the competitive order which, together with a posthumous article,[1] will be studied in a later section.

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[1] Cf. also an alternative and highly useful treatment by Böhler: *Grundlehren der Nationalökonomie*, Bern, 1948.

Part II of Schneider's book strikes a much more distinctive note in regard to treatment. While the rationale of a dynamic treatment of economic phenomena is often stressed today, it is interesting to observe that Schneider refers back to an early German economist for a justification of its use.[2] Thus while Schneider puts the student through his paces in a strenuous account of micro-economics leading up to general equilibrium analysis, there is a strong undercurrent of criticism of comparative statics throughout the book. A significant methodological contribution comes from Schneider which arises out of this dissatisfaction with equilibrium analysis and more positively from his earlier studies of accounting and budgetary control in firms. Thus in the monograph mentioned in footnote 2, p. 177,[3] he makes the stimulating suggestion that the dynamic *ex-post*, *ex-ante* analysis associated particularly with macro-economics can do much to clarify the theory of the individual firm and furthermore that the process of adjustment made by the firm arising out of the disparity between its expectations and actual events would be reflected in the change in the assets structure of the firm. Many economists will feel that this "Verschmelzung" of economics and accounting is timely and there are already signs that this sort of approach might be fruitful. Schneider himself does not follow out this suggestion to any great extent in the *Einführung*. He does, however, represent price and output decisions manifested in the usual two-dimensional diagrams as 'conjectural' estimates by the entrepreneur and treats the theory of duopoly dynamically although the latter analysis is not particularly illuminating.

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[1] "Möglichkeit und Grenzen der Wirtschaftslenkung" (*Jahrbuch fur die Ordnung von Wirtschaft und Gesellschaft*, II, 1949).

[2] See Wilhelm Lexis: *Allgemeine Volkswirtschaftslehre*, Chapter 1, and Schneider, *Einführung*, p. 5, and his small monograph mentioned in footnote 7, pp. 7–8. Cf., however, the defence of statics on methodological grounds in Stackelberg's *Grundlagen*, Part IV, Chapter 1.

[3] Cf., also his earlier article "Absatz, Produktion und Lagerhaltung bei einfacher Produktion" (*Archiv für Mathematische Wirtschafts und Sozialforschung*, 1938).

III

THE THEORY OF DUOPOLY AND OLIGOPOLY

The interest aroused by the development of imperfect competition in the early '30s was matched by many ingenious attempts to discover further solutions to the duopoly and oligopoly cases. Earlier discussions of these market forms by German writers have received some attention from American writers,[1] while both authors whose work we are now considering were in the forefront of discussion in the early '30s but so far their later contributions have eluded criticism and comment.[2]

Stackelberg in his earlier work criticised very strongly the attempts made to discern equilibrium solutions in the oligopoly case and he ascribed this attempt to make equilibrium economics embrace all market situations to the psychological resistance of 'liberal' economists to discussion of possible market forms where the 'automatic' working of the price system might not be evident.[3] His later work, however, is interesting for the ordered retreat made from his extreme position in his earlier work in *Marktform und Gleichgewicht*.

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[1] For example, Karl Forchenheimer: "Theoretisches zum unvollständigen Monopol (*Schmollers Jahrbuch*, 1908), noted by Stigler in his "Notes on the Theory of Duopoly" (*J.P.E.*, 1940). Forchenheimer deals with the 'price leadership' case. Also Paul Braess, "Kritisches zur Monopol- und Duopoltheorie" (*Archiv für Sozialwissenschaft*, 1931) noted by Chamberlin in *Theory of Monopolistic Competition*, Chapter 3. Stackelberg has pointed out an independent study by Wilhelm Lexis (cf., footnote 2, p. 179) giving similar conclusions to those reached by Bertrand. See Lexis' "Monopol" in the *Handwörterbuch der Staatswissenschaften*, 1st Edition. An amusing example of duopoly used for illustrative purposes in German economic literature is that of the two Clyde steamship companies who drove one another out of business. See E. A. Fuhr: "Zur Preisbildung" (*Zeitschrift für die Gesamte Staatswissenschaft*, 1900).

[2] An important exception is the critique of Schneider's dynamic treatment of duopoly by Hans Brems: "Some Notes on Duopoly Theory" (*Nordisk Tidskrift for Teknisk Økonomi*, 1948), written in English. I have had to rely on Brems' account of Schneider's earlier contribution to this field published in the *Archiv für Mathematische Wirtschaft- und Sozialforschung*, 1942, as the latter periodical is not available in Britain.

[3] Cf. Stackelberg: "Der typische Fehlschluss in der Theorie der Gleichgewichtlosen Marktformen" (*Zeitschrift für die Gesamte Staatswissenschaft*, 1935). This is an important article for an understanding of Stackelberg's "Weltanschauung". Although Stackelberg singles out liberal economists for criticism because of their neglect of 'unstable' market forms, he makes it clear that this criticism mainly implies that all theories to some extent are historically conditioned. Far from being an attack on liberal thought, the article is a defence of the universality of economic thought as against the then current Nazi view that German economic thought was essentially different (and by implication superior) to 'Anglo-Saxon' or 'Jewish' thought. Cf. also Section 4 below.

In the latter work, Stackelberg distinguished between three possible solutions to the duopoly problem in terms of partial equilibrium analysis—the Cournot solution (identified by the intersection of the 'output reaction curves' of the two duopolists), the 'a symmetrical solution' (where the outputs of each duopolist are determined by the point of tangency of an iso-profit curve of the output leader with the reaction curve of the output follower) and the 'Bowley' solution (where both duopolists seek to sell their independent output, i.e., both seek to be output leaders).[1] While in his *Marktform* he insisted that partial equilibrium analysis offered a full explanation of oligopolistic behaviour and that if none of these solutions indicated equilibrium, no equilibrium would be possible, his later work introduces important modifications which must now be noted although Stackelberg continued to hold that the oligopolistic situation was always potentially an unstable one.[2]

For instance, in the *Grundlagen*, the earlier view that duopoly and oligopoly are transitional market forms does still persist. Thus, Stackelberg holds, if we make the usual assumptions about profit maximisation and consider only the two action parameters, price and output, then "only the formation of a cartel or state regulation of the market can bring the struggle to an end and restore equilibrium" (*Grundlagen*, p. 218). The cartel solution is reminiscent of Braess (cf., footnote 1, p. 180) and indeed both authors express the view that this outcome merely transfers the struggle to within the cartel itself.[3] But apart from the 'institutional' solution by which a metamorphosis of the market form is postulated, Stackelberg transfers a good deal of emphasis to the so-called 'inertia' factors (Trägheitsfaktoren) which mitigate the struggle. Important in this respect are such factors as the speed of reaction to individual changes in price and output policy, the extent to which entrepreneurs adopt 'full cost' or other forms of pricing not based upon the equation of marginal cost and marginal revenue, the extent to which output is regulated rather than prices (a factor which might make the Cournot solution more realistic), the importance of price rigidity and so on. Apart from the earlier discussions of these factors by such writers as Zwiedeneck-Südenhorst and Schmalenbach, Stackelberg has been influenced to some extent by the empirical studies of his contemporaries Möller and Klebs.[1] Stackelberg himself devoted some attention to the problem

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[1] See *Marktform und Gleichgewicht*, Chapter IV, and *Grundlagen*, Part IV, Chapter 3. A brief account of this section is given in Triffin: *Monopolistic Competition and General Equilibrium Theory*, and in Leontief's article, "Stackelberg on Monopolistic Competition" (*J.P.E.*, 1936). An excellent simplified exposition of Stackelberg's duopoly and bi-lateral monopoly analysis is provided by E. J. R. Heyward: *Economic Record*, 1941, pp. 99–106.

[2] See particularly his article in *Weltwirtschaftliches Archiv*, 1938, mentioned in footnote 2, p. 177, and his "Theorie der Vertriebspolitik und der Qualitätvariationen" (*Schmollers Jahrbuch*, 1939); also *Grundlagen*, Part IV, Chapter 6.

[3] There is a theory of cartel formation implicit in Stackelberg's diagrams of price reaction curves (see *Marktform und Gleichgewicht*, Chapter 4). If we assume that the two duopolists A and B attempt to reach agreement about prices, then, if a fixed price is to be determined, the first formal condition of agreement is that $P_A = P_B$. In the usual diagram in which we label the axes P_A and P_B, then a 45° line from the origin is the locus of all possible positions denoting agreement. If each duopolist chooses a minimum profit indifference (or iso-profit) curve and they overlap as shown in the diagram (I_A and I_B), then we have an 'area of agreement' and the segment of the 45° line within this area becomes a 'contract curve'. No agreement will be reached unless this

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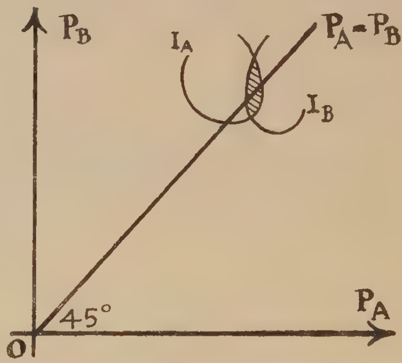
condition is fulfilled. Since considering this analysis, I have discovered that it has been given much more extended treatment by Dr. Hans Brems in his highly original work, *Some Problems of Monopolistic Competition*, Chapters 14 and 15, which is to be published as one of the Harvard Economic Studies. Not only does Dr. Brems develop this theory in detail both in terms of price and quota agreements, showing that the minimum 'effective' iso-profit curves can represent both conjectural and autonomous behaviour, but he is able to express Morgenstern and Neumann coalition problems in terms of this approach.



[1] Some emphasis is placed, in the work of a number of modern German writers, including Schneider and Stackelberg, upon Zwiedeneck-Südenhorst's 'principle of price inertia' (Trägheitsgesetz des Verkehrs) which emphasises the importance of the historical element in price fixing. See his article, "Kritisches und Positives zur Preislehre" (II), (*Zeitschrift für die Gesamte Staatswissenschaft*, 1909). Schmalenbach's *Grundlagen der Selbstkostenrechnung und Preispolitik* (Leipzig, 1930) is perhaps better known.

The author would like to direct special attention to the work of Möller and Klebs. Möller, a pupil of Stackelberg, has written a most interesting study of the sales policy appropriate in different market forms in which he compares the economists' and accountants' conclusions (see his *Kalkulation, Absatzpolitik und Preisbildung*, Springer-Verlag, Wien, 1941). There is a full account of 'marginal cost' and 'full cost' pricing which has long been discussed by German accounting theorists such as Schmalenbach and Mellerowicz. An isolated quotation does much less than justice to his study but one of his conclusions demands attention: "if accountants despite their close connection with practical affairs cannot identify any form of oligopolistic sales policy, then one may be quite sure that this type of behaviour is seldom met with. This explains the fact that in markets in which oligopoly conditions appear to obtain, in reality stable price policies prevail. The unstable equilibrium in oligopolistic markets rests essentially upon the instability of oligopolistic price policy but the latter is seldom encountered in real situations." Klebs' *Kartellform und Preisbildung* (Stuttgart und Berlin, 1939) gives a full and up-to-date study of cartel formation related to modern theoretical studies of imperfect competition.

of product differentiation but concluded that the latter by segmentation of the market did not mitigate the instability of oligopoly.[1]

The problem of successive adjustment to rivals' policy in oligopolistic situations particularly lends itself to discussion in dynamic terms. The main problem in any such analysis is that of the choice of assumption but, as Schneider indicates, a degree of elasticity is introduced into our analysis if we can indicate not only how rivals react to one another's policy but also when they will do so. In his *Einführung* he introduces such a dynamic treatment, prefacing his analysis with three sets of assumptions :

(*a*) Each seller regards his sales and cost function as given, i.e., his anticipated cost and sales curves are realised. Thus $C_A = f_A(Q_A)$, $C_B = f_B(Q_B)$, i.e., costs depend on output and $\pi_A = F_A(p_A, p_B)$, $\pi_B = F_B(p_A, p_B)$, i.e., sales depend on price charged by the individual seller and that of his rival also.

(*b*) Seller A sets his price in period 1, and seller B reacts to it in period 2, seller A in turn to B's price in period 3, *et seq*. The dynamic relation can thus be written

$$P_A^t = F(P_B^{t-1}, P_A^{t-2}, P_B^{t-3} \ldots\ldots)$$

(*c*) Each seller sets his price in the relevant period in the expectation that his rival's price will remain constant (e.g., for A in period 3, $P_B^{t2} = P_B^{t3}$, etc.). The chain of reactions is brought about by the bi-period 'surprises' experienced by each seller, A in periods 2, 4, 6, etc., and B in periods 3, 5, 7, etc.

For given sales and costs functions, Schneider is able to demonstrate on the basis of these assumptions that the chain of reactions will finally produce equilibrium prices.

It is evident that such an analysis only demonstrates how much more likely conjectural behaviour would be introduced into the real sequence of events so that recourse to the assumption of given expectations makes the analysis unduly restrictive. This much is admitted by Schneider for in the end he supports the view that analogies drawn between warfare, games strategies, etc., and the oligopolistic situation à la Edgeworth and Rothschild give us a clearer insight into entrepreneurial motivation.[1]

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[1] Cf. his article in *Schmollers Jahrbuch* mentioned in footnote 2, p. 181. He maintains that the oligopolistic struggle reflects itself in percussive advertising designed to establish and maintain the 'independent' position—" only in this way can we account for the fact that when agreements are made between competitors, particular emphasis is placed upon the limitation of advertising outlays ".

* * * *

The study of these attempts to elucidate the oligopoly case leads one to conclude that a very real difficulty exists as to the degree of abstraction required in analysis of this kind and the appropriate method of approach. The use of the familiar equlibrium analysis is restrictive both in regard to the problem of the choice of assumptions to be made and the number of action parameters which it is possible to study simultaneously. The use of extended analogy such as that expressed in terms of the strategy and tactics of combined operations by Rothschild[2] is suggestive but hardly capable of adoption for systematic treatment. If such analogies are to be drawn as an indication of the background to entrepreneurial motivation, it is as well that they should be as comprehensive as possible. While Mr. Rothschild correctly stresses that the background to oligopoly is " the continuous existence of potential struggle ", he has perhaps been a little too selective in his examples of the outcome of oligopolistic situations. For the individual firm in the oligopoly situation, the great unknown is the shape, location and continuity of the individual sales curve, and the range of alternative courses of action possible in order to ascertain and influence the shape of the sales curve are many and varied. The actual process by which the firm tries to relate its price and output to sales is probably a good deal more tentative and the mere existence of a market form with few sellers is not necessarily to say that they regard themselves as in an oligopolistic situation. Even then, the recognition by entrepreneurs of ' circular interdependence ', does not narrow down the alternatives open to them to warfare. It is more likely that Mr. Rothschild would find more evidence for his general conclusion in Hobbes' *Leviathan* than in Clausewitz's *Principles of War*.[1]

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[1] While one can agree with Professor Stigler (*loc. cit.*) that " it is not, in general, sufficient to possess merely the initial anticipations of each duopolist concerning his rival's reactions; data must also be provided to determine revisions of these anticipations ", the dynamic analysis of Schneider modifies the conclusions drawn from this statement. Thus it is not necessary to maintain that duopoly theory must assume that anticipations are always correct, as Professor Stigler concludes from his statement, but that reactions to the non-fulfilment of expectations in the dynamic series must be uniform.

[2] K. Rothschild : " Price Theory and Oligopoly " (*Economic Journal*, 1947).

IV

STACKELBERG AND THE ECONOMIC ORDER

It is unfortunate that reviewers of Stackelberg's *Marktform und Gleichgewicht* should have created the impression that he wrote the book as a " pæan of the Corporate State ".[2] Because a writer describes the possible forms of state supervision of unstable market forms under Fascism, it does not necessarily follow that he seeks to justify such intervention. Stackelberg himself was extremely disappointed at the reception afforded to his book abroad and wrote in 1938, " such a reproach is painful to me not only because the corporate state deserves no ' pæan ', but because theoretical studies should be kept as far as possible free from ' hymns of praise '. Furthermore, I have been unable to discover this ' pæan ' in my work."[3] On the contrary, the signal characteristic of his work is its complete freedom from any attempt to justify any particular political order. His views on economic policy scattered among his writings do not in fact presuppose any rigid ideological premises, and they deserve sympathetic consideration.

Stackelberg regarded the price mechanism as the main instrument of economic policy and maintained throughout his later work that it operated most efficiently in a perfectly competitive order.[4] This is not to say that he believed that the competitive order automatically emerged in a capitalist economy. Thus the very importance of maintaining competition on grounds of efficiency implied state action perhaps of a vigorous nature in order to establish it.[1]

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[1] " And therefore if any two men desire the same thing, which nevertheless they cannot both enjoy, they become enemies ; and in the way to their End (which is principally their own conservation, and sometimes their delectation only), endeavour to destroy, or subdue the other. And from hence it comes to passe, that where an Invader hath no more to feare, than another man's single power ; if one plant, sow, build or possesse a convenient Seat, others may probably be expected to come prepared with forces united, to dispossesse, and deprive him, not only of the fruits of his labour, but also of his life, or liberty. And the Invader is in the like danger of another."

" *And from the diffidence of one another, there is no way for any man to secure himselfe so reasonable, as Anticipation.*"—*Leviathan* : Part I, chapter 13.

[2] The phrase used by J. R. Hicks in his review in the *Economic Journal*, 1935. A similar account is given by Kaldor in *Economica*, 1936, and both Rothschild (*op. cit.*) and Triffin (*op. cit.*) appear to have accepted these opinions. Cf, however, the obituary notice of v. Stakelberg by Professor Walther Eucken : *Economic Journal*, March, 1948, pp. 132–135.

[3] *Weltwirtschaftliches Archiv*, 1938, p. 136.

[4] Cf., *Grundlagen*, Part VI, which in fact gives a clear statement of the rationale of the competitive order. A more succinct statement of his views on ' planning ' is to be found in a short article written in 1943 (cf., footnote 1, p. 179) and published posthumously.

So far as maintaining competition was concerned, Stackelberg favoured where possible the introduction of taxation of monopoly profits in such a way as to induce monopolists to adopt competitive pricing. To my knowledge, the scheme he had in mind was not worked out in detail but he computed a ' taxation formula ' designed to achieve this end. An alternative method fully discussed in our own literature is that of price control and Stackelberg devotes a short chapter of the *Grundlagen* to a study of state price regulation. But in view of his persistent belief in the instability introduced into the market economy by oligopoly, he believed that more direct methods of control might have to be introduced so as to ' transform ' oligopoly into ' organised competition ' or failing this into state-supervised ' syndicates ' (Zwangssyndikate).

So far as the ultimate ends of economic policy are concerned, Stackelberg maintained that they were realised in the particular system of income distribution postulated. In this connection he develops two important points in the last chapter of the *Grundlagen*. Firstly, he holds that it is not necessarily true to say that the personal distribution of income brought about by the competitive order is necessarily the most socially desirable.[2] From what we know of his own views on the subject, he favoured redistribution of income so long as it did not radically interfere with the competitive mechanism through its effects on incentive to wage-earners and entrepreneurs. Secondly, this view implied that the competitive economy was compatible with various types of income distribution. The process of transformation of functional income distribution brought about in the competitive order should only be brought about by fiscal measures acting as ' correctives ' and not by a reorganisation of the system of property rights. (Cf. *Grundlagen*, pp. 348–52.)

There is one notable omission in regard to economic policy in Stackelberg's work and that is the absence of any discussion of the appropriate policy to be adopted by the state in order to combat fluctuations in the level of national income, output and employment. There is a passing reference in the *Grundlagen* (p. 177) to the problem but nowhere in this work or in any others does he deal with the problem *in extenso*.

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[1] " Only those methods should be used which facilitate and do not hinder the transition to a competitive price system, but in this connection one should certainly not avoid the use of administrative controls."—ORDO (1949), p. 205.

[2] Cf. Stackelberg's review of Professor Eucken's " Grundlagen der Nationalökonomie " in *Weltwirtschaftliches Archiv*, May, 1940, p. 280.

* * * *

To summarise and criticise these various works in a few pages inevitably means that less than justice is done to the writers, but the author hopes that he has been able to supply enough information about them to induce those economists more immediately interested in price theory problems to investigate these works for themselves. He would also like to think that the language barrier is not so formidable as it might appear at first sight and that the return to more normal conditions of intellectual intercourse would make a task of this nature wholly superfluous.

The London School of Economics.

National Income, Exchange Rates and the Balance of Trade

By K. M. Savosnick

The following article[1] can be regarded as an attempt to eliminate the *ceteris paribus* assumptions usually made in the theory of exchange rates when supply and demand curves are assumed to be unchanged in the course of the analysis. We will here analyse the conceptual relationships between the size of the national income and the supply curves for exports and demand curves for imports and the effects of a devaluation upon the balance of trade and the equilibrium national income.

Symbols :

$Y_0 < Y_1 < Y_2 < Y_3$, etc. = national incomes.
V = Home investment.
X = Exports.
M = Imports.
D_m = Home demand and elasticity of demand for imports.
S_m = Foreign supply and elasticity of supply for imports.
D_x = Foreign demand and elasticity of demand for "our" exports.
S_x = Home supply and elasticity of supply for exports.
v_o = exchange rates before devaluation.
v_1 = exchange rates after devaluation of "our" currency.
D_mY_o, S_xY_o, etc., indicate D_m and S_x at the corresponding national income.
D_xv_o, S_mv_o, etc., indicate D_x and S_m at the corresponding exchange rates.

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[1] The article is also published in a somewhat different form (and also including a separate part concerning kinked demand curves in exchange rate theory) in ***Ekonomisk Tidskrift*, 3/1949**, Stockholm, by Karl-Olof Faxén and Kurt M. Savosnick. The above article has been revised, elaborated, and translated into English by Savosnick.

Assumptions :

1. We assume for the sake of simplicity that consumption, investments, etc., are functions of the *nominal* national income. The analysis will be equally simple if we also make the assumption of an unchanging general price level in spite of the changes in import and export prices which we shall introduce in the analysis. Both assumptions are equally untenable in a realistic analysis.
2. Constant elasticities of demand and supply in the relevant parts of the curves.
3. We assume for the sake of convenience that an increase of the national income will shift supply of exports (S_x) negatively and demand for imports (D_m) positively. (Shifts to the contrary are theoretically conceivable but will not be dealt with since conceptually the reasoning is the same in both cases).

Diagram 1a shows foreign demand for " our " exports and our supply of exports at different prices and at different national incomes. Here as elsewhere we assume that " our " country is so small that no change in its exports or imports will cause a change in the national income of the other country (the rest of the world) big enough to induce any noticeable shift of its demand or supply.

Diagram 1b shows foreign supply of imports at different prices and our demand for imports at different prices and different national incomes. In both 1a and 1b we have assumed constant exchange rates.

Diagram 2a is a projection of diagram 1a under different assumptions into a diagram where the ordinate measures the total value of exports and the abscissa measures the national income. (Constant exchange rates and constant elasticity of supply at changing national income). If the elasticity of demand for exports (D_x) is less than unity a negative shift of S_x as in diagram 1a will lead to a higher value of total exports and the export value line of diagram 2a will have a positive slope. Conversely, when D_x is greater than unity the line will obviously have a negative slope in diagram 2a. When D_x is unity the export value line in the national income diagram 2a will be horizontal. The actual degree of the slope of the line will in all cases (except when D_x is unity) depend both upon the elasticities and the magnitude of the negative shift of S_x caused by a given increase in national income.

Diagram 2b measures the import value at different national incomes but it must be noted that the slope of the import value line will always be positive regardless of the elasticity of demand for imports.

Diagram 2b can also be interpreted to represent what has been called the marginal propensity to import and indicates to what extent a rise in national income will induce a rise in the value of imports, but it must be observed that the marginal propensity to import according to this interpretation will change when foreign elasticity of supply changes. One can also interpret the corresponding export value curve of diagram 2a as indicating "the marginal propensity to export".

Diagram 3a illustrates roughly what is meant by a devaluation of the home currency; D_x will be shifted upwards and whatever the actual character of S_x may be, an increase of the total value of exports (measured in home currency) will occur. The magnitude of the increase will depend upon the elasticities of demand and supply, and the greater the two elasticities are, the greater will be the total increase.

The devaluation from v_0 to v_1 will thus result in an upward shift of the export value curve as in diagram 4a since the total value of exports will increase at each national income.

Diagram 3b shows the effects of devaluation on the import side and its effects upon the total value of imports (in home currency). The devaluation can be interpreted as a shift upwards of the supply curve and according to the elasticity of D_m it will result in an increase or decrease of total value of imports.

If D_m is less than unity an increase in the value of imports will occur as a result of devaluation, and this can be projected as a shift upwards of the corresponding import value line of diagram 4b.

If, on the contrary, D_m is greater than unity, a decrease of total value of imports will occur, and this can accordingly be translated into a shift downwards of the import value curve of diagram 4b.

Diagram 5 shows the balance of trade $(X - M)$ in home currency at different national incomes and at different exchange rates; the intersection between the "balance curve" and the national income axis indicates the national income at which the balance of trade will be zero at the current exchange rate. The slope of the curve will be negative in all cases except when the export value curve of diagram 4a has a greater *positive* slope than the *positive* slope of the import line of diagram 4b. We believe this to be rather unlikely to occur since it implies either a very low elasticity of demand for exports combined with a comparatively great negative shift of supply of exports S_x for each increase of the national income. However, an increase in national income is likely to induce a greater positive shift of demand for imports than the corresponding negative shift of supply of exports. Since this paper is an attempt to introduce a new conceptual approach to devaluation rather than an outline of all possible effects of a devaluation we will concentrate upon the assumption of a negatively sloped balance curve as in diagram 5.

When a given devaluation results in an increase in the value of exports and at the same time in a decrease in the value of imports, the balance curve will obviously be shifted upwards relative to v_o – balance curve. With a balance curve having a negative slope that will involve a shift to the right of the "zero-balance-of-trade-point"—that is the intersection of the balance line with the abscissa.

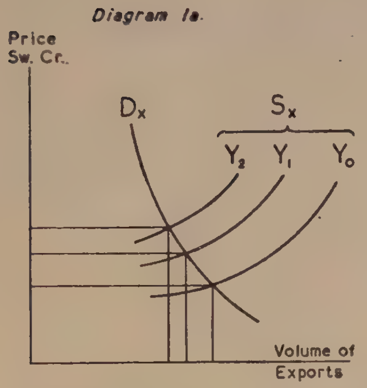
If both import value and export value increase as a result of devaluation the balance curve may still be shifted upwards unless the increase in import value is greater than the increase in export value. If the latter is the case a downward shift will occur. Joan Robinson has arrived at a simple formula which shows the conditions which have to be satisfied for a devaluation to result in an increase in the balance of trade (assuming constant national income). (*Essays in the theory of Employment*, 1947, p. 142 footnote, and reprinted in *Readings in the Theory of International Trade*, 1949, p. 91).

Diagram 6 gives us the usual 45-degree diagram with a national expenditure curve for an open society. The national expenditure $Y = C + V + (X - M)$ is related to different exchange rates v_0, v_1, etc.

We have here assumed that there exists a discrepancy between the "general equilibrium"—national income (*g*) and the "balance of trade equilibrium"—national income (*b*) at the original exchange rate v_o. We then assume that the balance line will experience a shift upwards of a particular magnitude when the currency is devalued by a certain percentage. It is then easy to find *the* equilibrium national income (e) where the balance of trade is zero *and* the corresponding exchange rate v_m. In a devaluation discussion one often meets the argument against devaluation that when g and b move to the right, the distance between them will increase and we shall end up with both a higher national income and a higher deficit in the balance of trade. This argument can be interpreted as resting upon a particular assumption: that the "closed economy" spending function $(C+V)$ has a slope greater than 45° at higher national incomes which is the same as an angle greater than 45° between the "open economy" spending function $(C+V+X-M)$ and the balance line in the relevant parts of diagram 6. Under such assumption an appreciation will apparently be the solution, since it will shift the balance line downwards, and a contraction will occur. In the case of "unfavourable" elasticities, that is when a devaluation will shift the balance line downwards, an appreciation will ordinarily be the solution to the problem of arriving at point g.

With the foregoing analysis we have hoped to produce a new "conceptual" apparatus for a theoretical discussion of the problems connected with exchange rate policy on the basis of particular assumptions concerning elasticities of demand and supply in international trade. These assumptions can then be criticised so far as accurate trade and national income statistics are available as well as on theoretical grounds. Since a number of economists are advocating particular kinds of exchange rate policies they have here an opportunity to state their different assumptions explicitly. Admittedly present conditions involve very particular and peculiar assumptions of the shape of the demand and supply functions but even with entirely regulated trade the analysis may prove useful if only to show the nature of changes in pressure and tension in a controlled society with a disequilibrium in its trade.

Stockholm.



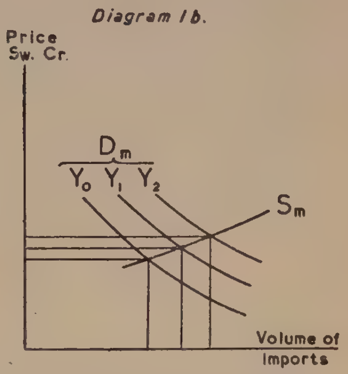
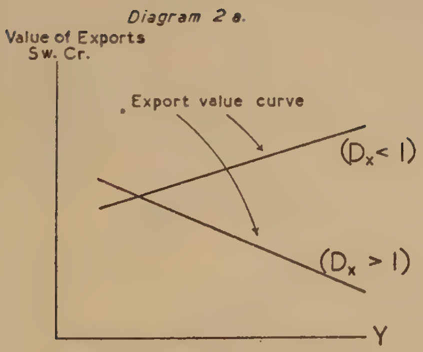


Diagram 1*a*. S_x, supply of exports shifted negatively at rising national income. Volume and price of exports changes as well as value of exports.
D_x = foreign demand for exports.

Diagram 1*b*. Demand for imports D_m shifted negatively at rising national income. Volume and price of imports increase as well as total value of imports.
S_m = foreign supply of imports.



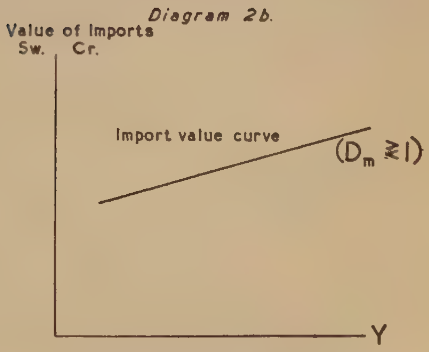
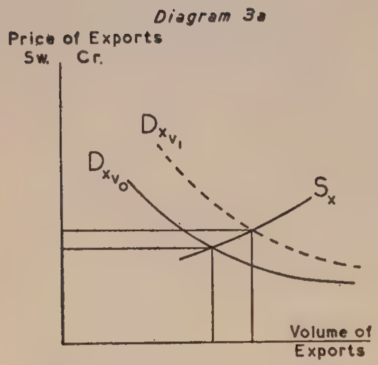


Diagram 2*a*. Value of exports changing as a result of shift of supply curve in diagram 1*a* when national income changes. When D_x is less than unity total value of exports will increase as a result of negative shift of supply curve.
When D_x is greater than unity it will decrease.

Diagram 2*b*. Value of imports increasing as a result of positive shift of demand. Slope of curve always more or less positive.



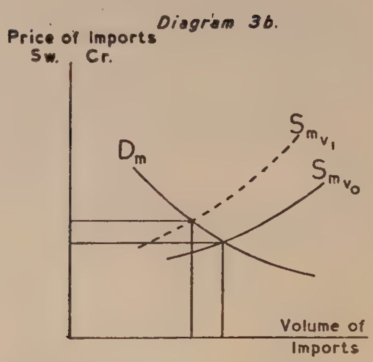
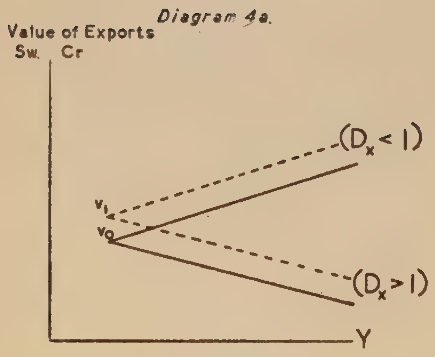


Diagram 3*a*. Demand for exports shifted positively at devaluation from v_0 to v_1 (measured in home currency).
Value of exports (assuming no shift or change of supply function) always increasing at devaluation (measured in home currency).

Diagram 3*b*. Supply of imports shifted negatively according to degree of devaluation from v_0 to v_1 (measured in home currency).
Value of imports (assuming no change in demand) increasing if demand is less than unity and decreasing if it is greater than unity.



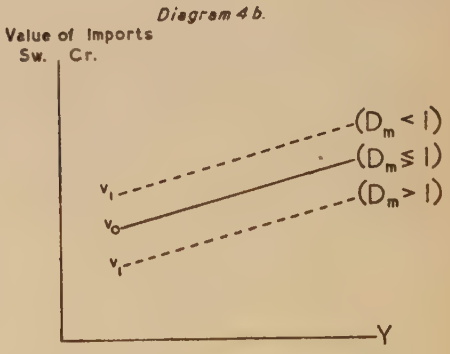


Diagram 4*a*. Export value curve of diagram 2*a* always shifted upwards (measured in home currency) when currency is devalued from v_0 to v_1.
Magnitude of shift depending upon elasticities of supply and demand and percentage of devaluation.

Diagram 4*b*. Import value curve of diagram 2*b* shifted upwards or downwards at devaluation from v_0 to v_1. Character of shift depending upon elasticity of demand. Magnitude of shift depends upon the percentage of devaluation and elasticities of both demand and supply.

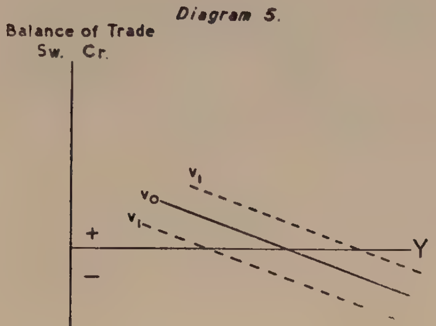


Diagram 5. Balance curve, made up by export value curve minus import value curve, shifted upwards or downwards at each given devaluation, according to corresponding shifts of export and import curves. For a shift downwards of the balance line the necessary but not satisfactory condition has to be fulfilled that D_m is less than unity.

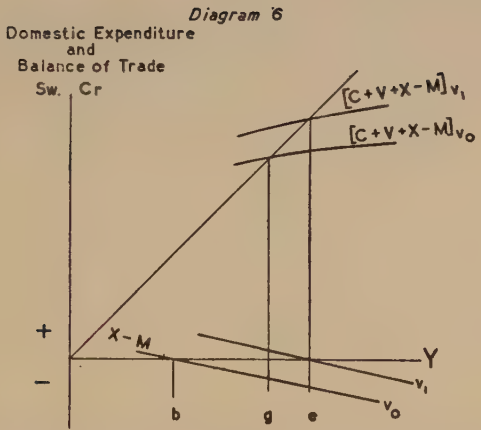


Diagram 6. Balance curve and domestic expenditure curve both shifted upwards as a result of devaluation.

United Kingdom Public Expenditure by Votes of Supply, 1793—1817

By Walter M. Stern

This article is intended as a first contribution to a wider study of the beginnings of public expenditure in the United Kingdom. Extraneous considerations have determined the limits of the period under review: 1793 marks the first appointment of Exchequer Loans Commissioners by the British Government, a measure committing Government to increased participation, at least temporarily, in the country's business life; 1817 sees the Exchequer Loans Commissioners set up as a permanent institution. The interim period represents the experimental stage of public investment. The choice of dates can, however, be justified on more general grounds. They delimit a period of wars (including liquidation of war commitments), during which Government expenditure was bound to expand; though such expansion reflected chiefly military aims and considerations, much of it was of enduring value (above all, that devoted to improved communications), and showed the directions in which Government sought to foster economic development. While therefore neglecting in this context purely military outlay, no historian of public expenditure can afford to disregard the war years.

The value of a study of votes of supply by themselves is limited by the nature of public accounting, not to speak of the honesty and accuracy of contemporary accounts. Votes of supply represent one of several forms in which public funds are disbursed; if the Government made recurring grants a charge on the Consolidated Fund or gave credit in the form of Exchequer bills, such outgoings would not be included among the expenditure classified here.[1] It is this difficulty which led Clifford[2] to complain of the impossibility of ascertaining the total advanced from the public purse towards the construction of a canal through the Isle of Dogs to improve the Port of London; the various Acts refrain from specifying amounts, and merely speak of "large sums".[1]

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[1] A credit of £500,000 in Exchequer bills granted to West Indies merchants whose goods were temporarily unsaleable in 1799 as a result of the war is an exception; it was separately voted in Parliament: *House of Commons Journals*, Vol. LV, p. 36. *House of Commons Journals* will in the following be quoted by the roman numeral for the volume and the arabic numeral for the page number only, e.g., LV, 36.

[2] F. Clifford: *History of Private Bill Legislation*, Vol. II, p. 654.

The attempt to eliminate ordinary current expenditure in studying "unusual" and capital expenditure has necessitated what must appear an arbitrary division between items included in, and excluded from, our classification.[2] There is little inherent justification for excluding expenditure on foreigners when they served in the British Forces but including it if they were refugees in Britain, for excluding expenditure on military buildings (among them military prisons and asylums) while including civil government buildings (among them civil prisons and asylums), for neglecting fees paid to contractors managing the prison hulks in England while classifying payments for the upkeep of the convict settlement at New South Wales. The line had to be drawn somewhere; these divisions appeared expedient.

A sum authorised by Parliament may be an outright grant, a loan, or the discharge of a debt incurred by public funds; in each case, votes of supply take identical forms. Only external evidence can establish the nature of the payment. Of eight votes for the East India Company between 1803 and 1816, £1,000,000 in 1803[3] was probably a grant; £1,000,000 in 1805[4] and again in 1806[5] represented debts owed to the Company for military expeditions undertaken on the Government's behalf,[6] whereas £1,500,000 in 1808[7] was a payment on account of further Government indebtedness.[8] £1,500,000 in 1811[9] and £2,500,000 in 1812[10] were loans.[11] Auber knows nothing of the payment of £2,000,000 in 1813,[12] but we learn from Philips[13] that in that year the Company demanded payment of an outstanding debt of £2,294,426 from the State; so presumably £2,000,000 was paid on account. No external evidence was found for a payment of £945,491 13s. 4d. voted in 1816,[14] but as it is not a round sum it is likely to have been the settlement of a precise indebtedness. The lack of distinction between grants and the discharge of obligations explains the order of magnitude of some of the items listed under the heading of Inventions and Discoveries. Between 1793 and 1815, a total of £205,147 10s. 10d. was voted, out of which considerably more than one half (£123,046 13s. 7d., to be exact) went to John Palmer[1] for an invention to speed up the handling of mail. It would be wrong to infer that Parliament valued Palmer's contribution to the public welfare more highly than that of Dr. Jenner (£30,000),[2] Edmund Cartwright (£10,000)[3] or Samuel Crompton (£5,000)[4]; the payments to Jenner, Cartwright and Crompton, like those made to Mungo Park and Anderson for exploration in Africa,[5] were grants, whereas John Palmer had a contract with the Post Office, entitling him to a percentage of the net revenue, which the Post Office was reluctant to pay. Unlike his fellow inventors, Palmer petitioned, not for an *ex gratia* award, but for what he claimed to be his legal due[6]; this explains the size of the payment voted to him.

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[1] A future contribution may shed some light on this particular question.

[2] Copies of the detailed tables on which this classification is based have been deposited with the British Library of Political and Economic Science.

[3] LVIII, 526. [4] LX, 444. [5] LXI, 482.

[6] Peter Auber: *An Analysis of the Constitution of the East India Company* (1826), Vol. I, pp. 528–9; B.P.P. 1812, Vol. IV, p. 447.

[7] LXIII, 434. [8] Auber: *loc. cit.* pp. 532–3. [9] LXVI, 339.

[10] LXVII, 430. [11] Auber: *loc. cit.* dates the former of the two loans 1810.

[12] LXVIII, 268. [13] C. H. Philips: *The East India Company, 1784—1834*, p. 186.

[14] LXXI, 432.

Total expenditure for the 25 years covered by this review, classified in the manner indicated, amounts to over £32,000,000, approximately £1,250,000 per year. This average figure, however, was not reached in any year before 1802. Between 1802 and 1817, there were only six years (1804, 1807, 1809, 1810, 1815 and 1817) in which the total fell short of the average. The largest expenditure in any one year was £3,586,000[7] in 1812, the smallest £352,000[7] in 1799. Stripped of short-term fluctuations, expenditure reveals a pattern: a steady rise of annual expenditure from 1793 to a culmination point in 1812–13, followed by a sharp contraction between 1813 and 1817. The inflationary tendencies of a war economy and the deflation incidental to the cessation of military operations are accurately reflected. It would be tempting to trace a correlation between the year-to-year variation of totals and the short-term cyclical fluctuations of the period, but the figures do not permit it. Where the annual average totals only £1,250,000, large individual payments such as those to the East India Company (which are never much below, and often above, £1,000,000) unduly distort the picture. The year in which they are voted is often accidental; their equivalent either has been, or will be, expended by the Company over a period of several years.

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[1] LXIII, 434; LXVII, 476.

[2] LVII, 544; LXII, 798.

[3] LXIV, 393.

[4] LXVII, 476.

[5] LXIII, 240.

[6] LXII, 285.

[7] Hundreds omitted.

From 1801 onwards, supplies for Ireland had to be voted by the British House of Commons. These supplies are included in the totals hitherto quoted, but have been classified separately from those for Great Britain,[1] since the policy of the Westminster Parliament towards Ireland is of political interest. In no one year did the total amount spent on Ireland equal that voted for the remainder of the United Kingdom. The significant comparison is not between totals, but between supplies voted per head of population. In order to eliminate short-term fluctuations, five-year averages have been used for votes of supply expenditure. These are the figures:

VOTES OF SUPPLY EXPENDITURE CLASSIFIED

	Five-Year Averages[2]		*per Head of Population*[3]	
	Great Britain	*Ireland*	*Great Britain*	*Ireland*
1801–05	£1,192,000	£163,000	2s. 3d.	7d.
1811–15	1,935,000	425,000	3s. 4d.	1s. 4d.

Neither in total nor in *per capita* expenditure did Ireland receive treatment as favourable as Great Britain, but the rate of growth of expenditure per head over the period covered by these figures is of the order of 50 per cent. for Great Britain and more than 100 per cent. for Ireland.

Classification of votes of supply expenditure was made under nine headings:

Agriculture, Industry, Invention, Discovery;
Overseas Trade and Deep Sea Navigation;
Inland Communications;
Public and Civil Buildings and Local Amenities;
Public Order and Criminal Settlements;
Religion, Ministers, Churches;
Science, Art and Education;
Assistance to the Needy;
War and Catastrophe Relief.

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[1] Where a vote applies to both, its total has been added to the Great Britain supplies, resulting in an under-statement of Irish supplies.

[2] Hundreds omitted.

[3] Population figures for Great Britain are census figures, for Ireland revised estimates as calculated by K. H. Connell in *Ec. Hist. Rev.* 1946, p. 123 ("The Population of Ireland in the Eighteenth Century"): ten-yearly increases of 17 per cent. over the estimate of 4,753,000 for 1791 make the population of Ireland 5,561,010 in 1801 and 6,506,382 in 1811.

Seven of these headings are subdivided into supplies for Great Britain and supplies for Ireland[1]; no Irish supplies were voted either for Public Order and Criminal Settlements or for War and Catastrophe Relief. Looking at public expenditure through contemporary eyes, we are justified in distinguishing between economically and purely socially productive expenditure; our first three headings represent the former, the remainder the latter. Using this distinction, we find economically productive expenditure accounting for £15,717,000[2] out of £32,387,000,[2] or 48·5 per cent. of the total; social expenditure makes up the other 51·5 per cent. Economically productive expenditure is chiefly concentrated on Great Britain; under the heading of Overseas Trade and Deep Sea Navigation, no supplies at all were voted for Ireland between 1801 and 1806, and the column of Irish supplies under the heading of Inland Communications does not begin till 1813, when it became imperative to rescue two Irish canals from impending insolvency. Ireland, on the other hand, absorbed the lion's share of socially productive expenditure; to appease revolutionary tendencies, social provision on a comparatively generous scale appeared indicated. Taking as an example the improvement of local amenities, we find Dublin receiving grants for paving, cleansing, lighting and widening its streets from 1801 onwards[3]; the total funds voted for municipal improvement in Dublin between 1801 and 1817, including a grant of £5,500 for Dublin water supply[4] in 1816, add up to almost £125,000. No town in Great Britain obtained any grant for similar purposes till 1815, when Parliament passed a vote in aid of the embankment of the Thames at Millbank,[5] which with another sum in the following year[4] totalled £11,500, but the motive was probably not to help London, but to safeguard the foundations of Millbank Penitentiary which were being laid at the time. No expenditure at all appears under the headings of religion, ministers, churches, education or hospitals for Great Britain until 1804, by which time Ireland had accustomed the Westminster Parliament to outlay for such purposes. The British Parliament became heir to its Irish predecessor's tradition; petitions for support in 1802[1] by two Dublin hospitals, the Roman Catholic Seminary at Maynooth, the Association for Discountenancing Vice and Promoting the Knowledge and Practice of the Christian Religion in Ireland, and the Dublin House for Female Orphans were obviously reiterations of petitions addressed to the Irish Parliament for many years. In assuming the mantle of its Irish predecessor, Parliament at Westminster gradually acquired new ideas regarding the purposes on which public money could legitimately be spent; years of support for Irish hospitals[2] had rendered it receptive to the plea of the Bethlem Lunatic Asylum in London, which between 1806 and 1813 received rebuilding grants of almost £73,000.[3] When the Cork Institution, Trinity College, Dublin, and the Belfast Academical Institution had all partaken of the largesse of Westminster, Edinburgh University suddenly discovered this new source of funds for the enlargement of academic facilities and for three successive years (1815,[4] 1816[5] and 1817[6]) wrung £10,000 out of Parliament.

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[1] For a considerable number of years, Irish supplies were voted in Irish currency. All such amounts have been converted into sterling at the rate of 21s. 8½d. Irish to the pound sterling, using a decimal value of 1.083.

[2] Hundreds omitted.

[3] The 1801 reference is LVI, 253.

[4] LXXI, 478.

[5] LXX, 395.

The importance of Ireland in connection with votes of supply is understated by the figures in more than one respect. Grants for lighthouses are, as a matter of principle, included in the general heading of Overseas Trade and Deep Sea Navigation, but a glance at the British harbours most prominently represented in the list (Port Patrick,[7] Holyhead[8] and Ardrossan[9]) show that communications with Ireland were a dominant consideration. A similar picture is revealed of roads and bridges (general heading of Inland Communications) in Great Britain; grants for the Holyhead and Port Patrick roads in 1813,[10] the London–Holyhead and London–Bangor roads in 1815[11] and again in 1816,[12] and the Holyhead road in 1817,[13] prove the concern of the British authorities for communications with Ireland. As for Irish harbours, it is safe to say that only ports serving the routes to and from Great Britain had any chance of a grant from Westminster; the list is made up of Dundrum Bay,[1] Howth,[2] Ardglass,[3] Dunmore[4] and Dublin.[5] Between 1807 and 1817, these Irish harbours received supplies totalling almost £368,000, as compared to a total of £293,000 for British harbours and lighthouses (including Heligoland) between 1793 and 1817.

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[1] Grants for 1801 were in response to petitions addressed to the Irish Parliament, which are not in the *House of Commons Journals*. All the institutions petitioned in 1802: LVII, 259–62.

[2] By 1816, the Foundling, Westmorland Lock, Fever, Lying-In, Dr. Steevens', Sir Patrick Dun's and Incurables' Hospitals in Dublin, the Richmond Lunatic Asylum and the Green Coat Hospital at Cork were all receiving support from votes of supply: LXXI, 363–5, 478 for all these; and St. Patrick's Hospital, Dublin, had done so in 1811 (LXVI, 209) and 1812 (LXVII, 188).

[3] LXI, 309; LXVI, 324; LXVII, 475; LXVIII, 296.

[4] LXX, 418.

[5] LXXI, 478.

[6] LXXII, 359.

[7] LVII, 43, 297; LVIII, 525; LIX, 383; LXV, 450.

[8] LXIII, 434; LXV, 369; LXVI, 324; LXVII, 268; LXVIII, 177; LXIX, 165; LXX, 395; LXXI, 478; LXXII, 435.

[9] LXVII, 36.

[10] LXVIII, 36.

[11] LXX, 395.

[12] LXXI, 478.

[13] LXXII, 435.

Public expenditure during a war is inevitably distorted by military needs. Even a Parliament of landowners might have hesitated in peacetime to vote ungrudgingly such high grants for agricultural purposes, but the preoccupation with the nation's foodstuffs justified the expenditure. The Board of Agriculture received a steady and comparatively modest £3,000 a year, increased to £5,500 in 1810[6] and 1812[7] and to £4,800 in 1811[8]; in 1801, a special grant of £800[9] was voted to Arthur Young to be awarded by him in a competition for the best essay on the breaking up of grasslands. Assuming that the Dublin Society for Promoting Husbandry and Other Useful Arts in Ireland and the drainage of Irish bogs exclusively benefited agriculture, over £150,000 was voted for Irish agricultural purposes between 1801 and 1817. These figures are the more impressive in the almost complete absence of grants for industry. The only exceptions were an annual grant to the Trustees for Linen and Hempen Manufactures in Ireland, amounting to £19,938 9s. 3.[10] and payments made for a very small gold-mine in County Wicklow, which belonged to H.M. George III; it was apparently closed in 1809, as it then ceases to receive further votes.

Agricultural produce figures prominently in rewards to inventors. In the very first year of the war, Dr. Cuthbert Gordon and William Gordon, a nurseryman, received small awards[11] for discovering and cultivating plants used for dyeing textiles, thus dispensing with imported dyestuffs. In 1800, John Davis discovered a method of purifying wheat which had suffered from smut, and was suitably rewarded.[1] Distemper in horned cattle was dealt with by a method originating with Layard; the vote of £116 19s. 0d. for him in 1805[2] could hardly have been a reward, but at least compensated him for his outlay. The preoccupation with foodstuffs is also apparent in votes made available from time to time for the purchase of essential food supplies. In 1800, Parliament granted £50,000 for the storage and distribution of herrings in the United Kingdom,[3] and present-day Ministers of Food may draw comfort from the fact that even during the Napoleonic wars, providing stores against an emergency was not always a profitable transaction; in 1806, Parliament compensated the importers of these herrings for their losses by a vote of £25,000.[4] Over £2,000,000 was paid in corn import bounties in 1802–3,[5] and a famine in the Shetland Islands in 1814 led to grain and potato imports valued at £2,000.[6] Cash grants totalling £20,000 had been made, again for famine relief, to the Orkney and Shetland Islands in 1804.[7]

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[1] LXII, 798.

[2] LXIII, 262; LXIV, 255; LXV, 369; LXVI, 210; LXVII, 187; LXVIII, 409; LXIX, 278; LXX, 217; LXXI, 478; LXXII, 387.

[3] LXV, 201; LXIX, 390.

[4] LXIX, 278; LXXII, 387.

[5] LXX, 381.

[6] LXV, 387.

[7] LXVII, 224.

[8] LXVI, 204.

[9] LVI, 541.

[10] Irish £21,600. The manner in which this grant was used for the industry is explained by Conrad Gill: *The Rise of the Irish Linen Industry*, p. 214.

[11] XLVIII, 292.

Of £6,600,000 relief payments in our period, the great majority is due to the war; apart from small grants to Dominica in respect of fire damage in 1808[8] and St. Vincent in respect of a volcanic eruption in 1813,[9] the only substantial exception is a remnant from an earlier war, payments made to American loyalists, which continued right to the end of our period; they were, however, gradually scaled down, and in 1817 only £13,500[10] was set aside for this purpose. How far such relief payments should come into our classification at all or how far they ought to be regarded as purely military expenditure, it is impossible to determine with any accuracy. Similar considerations apply to grants for migration. These do not form a large part of the total; they are given in only three years out of the 25 (1793, 1794 and 1802) and in all amount to a mere £37,500. Only two grants, however (both for especially insignificant amounts), are made to people migrating for reasons economic rather than political: in 1793, emigration from the Scottish Highlands was assisted to the tune of £386 15s. 6d.,[11] and in 1802 an amount of £78[12] was contributed to the expenses of free settlers emigrating to New South Wales. With all other migrants, political motives are apparent; they were negroes, either loyalists from the American War of Independence[1] or Maroons,[2] settled in Nova Scotia where they suffered from the cold and damp climate, who were assisted in transferring to Sierra Leone,[3] more American loyalists going to Canada,[4] and whale fishermen unable, owing to the war, to ply their trade in Nova Scotia and therefore migrating to Milford Haven.[5]

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[1] LV, 768.
[2] LX, 144.
[3] LV, 906.
[4] LXI, 419.
[5] LVII, 298, 577; LVIII, 91.
[6] LXIX, 165.
[7] LIX, 382.
[8] LXIII, 434.
[9] LXVIII, 546.
[10] LXXII, 339.
[11] XLVIII, 414.
[12] LVII, 298.

Nor are payments classified under the heading of Overseas Trade and Deep Sea Navigation given for purely economic reasons. We mentioned (p. 196, *n.* 1) the credit of £500,000 granted to West Indies merchants—at Liverpool, when the war prevented them from disposing of colonial imports in their customary markets. Similarly, bounties were granted between 1807 and 1811[6] to importers of Newfoundland fish at Teignmouth, Poole and Clydebank upon the sale of their goods, because the war had all but extinguished their trade. How far harbours and lighthouses were financed for political rather than economic reasons, has already been considered; £13,500 for lighthouses at Heligoland in 1810–11[7] would certainly not have qualified as "productive expenditure" in peacetime, though it was a useful contribution to blockade-running. Payments to the East India Company, as we have seen, were also concerned with the war rather than trade. The same applies to those to the Levant Company, which was still responsible for maintaining an ambassador and consuls in the Levant. It had become almost a tradition that, whenever there was a war and its trade route in the Mediterranean was seriously threatened, its turnover fell to insignificant proportions and it looked to the Government for help.[8] From 1785 onwards, the Company had stood on its own feet, but by 1794 French domination of the Mediterranean once again forced the Company to petition Parliament for a grant. £5,000 was the annual sum which Parliament gave to the Levant Company for nine years between 1794 and 1808[9]; though the Company had at the outset explained that its annual expenses amounted to £8,000[10] and upon a later occasion solicited additional help owing to the regrettable state of disrepair into which the ambassador's house at Constantinople had fallen,[1] its plight failed to move Parliament to a higher grant. Free trade was in the air at Westminster; Parliament's displeasure at having to support monopolist chartered companies at all foreshadowed the surrender of the Levant Company's charter in 1825.[2] The grant of 1808 was the last ever made to the levant Company[3]; British domination of the Mediterranean eased its trading position in subsequent years.

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[1] F. A. J. Utting: *The Story of Sierra Leone*, pp. 88–9. [2] *Ibid.*, p. 104.
[3] XLVIII, 414; LVII, 596. [4] XLVIII, 414. [5] XLVIII, 427; XLIX, 175.
[6] LXII, 649; LXIII, 240, 415; LXIV, 245, 340; LXVI, 324.
[7] LXV, 449; LXVI, 303. [8] A. C. Wood: *The History of the Levant Company*, p. 161.
[9] 1794: XLIX, 399. 1796: LI, 654. 1798 (for two years): LIII, 492. 1799: LIV, 373. 1800: LV, 768. 1801: LVI, 540. 1802: LVII, 577. 1808: LXIII, 319.
[10] XLIX, 176.

Two chartered companies in Africa received votes of supply during our period, one for protecting the slave trade, the other because it opposed it. The Company of Merchants trading to Africa is the older of the two, established in 1750 and dissolved in 1821;[4] it maintained forts and settlements along the Gold Coast. It had been organised in a manner which made it depend entirely on Parliament for its income, for which it petitioned annually,[5] and the normal yearly grant at the outset of our period was £13,000, though the amount was frequently increased to compensate the Company for extraordinary expenditure. Almost annually, the Company produced special reasons for requiring a grant above the normal, but Parliament was by no means prepared annually to listen to these pleas. The forts and settlements along the Gold Coast served the protection of the slave trade in which the members as well as the staff of the Company engaged,[6] so that upon the abolition of that trade in 1807, the Company petitioned Parliament for an allocation over and above its ordinary grant in order to compensate its officers for the loss of a lucrative occupation.[7] The request was granted to the extent of an additional £5,000 per annum from 1808 onwards.[8] The Company succeeded by adroit parliamentary tactics in outlasting by fourteen years the end of the slave trade, though it came under increasing criticism in Parliament; in 1811, so strong was the disapproval expressed by a parliamentary committee of the Company's conduct of business that, for the only year in our period, no supplies were voted for the upkeep of the forts and settlements.[9] The deficiency was, however, repaired by

[1] LV, 351.
[2] Wood: *op. cit.*, pp. 199–202.
[3] *Ibid.*, p. 191.
[4] E. C. Martin: *The British West African Settlements, 1750—1821*, p. ix.
[5] *Ibid.*, pp. 16–7.
[6] *Ibid.*, p. 39.
[7] LXIII, 101.
[8] For 1808: LXIII, 416.
[9] Martin: *op. cit.*, pp. 154–6.

a grant of almost twice the normal size in the following year.[1]

The position of the Sierra Leone Company in Parliament was very much stronger. It had obtained a charter in 1791, and though its purposes were given as trade, it was primarily the stronghold of anti-slavery enthusiasts[2] and commanded in the House the eloquence of righteous indignation issuing forth from Wilberforce and Thornton. The "Saints" used the Company in order to develop Sierra Leone as a territory for free negroes, an enterprise fraught with many setbacks, owing to raids by neighbouring tribes and the French. In 1800, the Company for the first time applied for a grant to Parliament, which responded with a vote of £4,000.[3] The same amount was granted in the following year[4] and £10,000 in 1802,[5] but in 1803 an Admiralty representative reported so unfavourably on the defences of Sierra Leone that the Chancellor of the Exchequer did not recommend the Company's petition and Parliament voted no money.[6] The Board of the Sierra Leone Company included parliamentarians of great experience; such accidents did not repeat themselves; as the result of a very favourable report, the authorities reversed their decision in 1804 and added the 1803 grant to the current one,[7] after which the Sierra Leone Company obtained regular aid till 1807.[8] Unlike its African rival, it was only too anxious to surrender its charter as soon as the slave trade had been abolished; Sierra Leone became a Crown Colony on the 1st January, 1808, and subsequent parliamentary votes of supply for the upkeep of the civil establishment of Sierra Leone form part of expenditure on the civil service, which is not included in our classification.

Under the heading of Inland Communications in Great Britain, the prevalence of payments to Scotland deserves mention. Two out of three canals supported are Scottish, one of them the Caledonian Canal, which between 1803 and 1817 received votes of supply amounting to

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[1] LXVII, 37, 510.

[2] Utting: *op. cit.*, pp. 88–9. Miss Martin: *op. cit.*, p. 113, says that on its first Board of Directors, "roughly the balance seems to have been preserved between profit-seeking and philanthropy".

[3] LV, 768. Miss Martin: *op. cit.*, p. 136, mentions that the Company also received £7,000 in 1800 to establish a fort. I have not been able to trace this payment; perhaps it was borne on the general naval vote.

[4] LVI, 541.

[5] LVII, 577.

[6] Martin: *op. cit.*, p. 138.

[7] LIX, 402.

[8] LX, 434; LXI, 221; LXII, 798.

£713,752 2s. 0d. Apart from those giving access to Ireland, the chief means of communication supported were Sutherland and Caithness roads in 1803,[1] a bridge over the river Spey in 1805,[2] the Contin to Ullapool road in 1810,[3] bridges over the rivers Cree and Kenn in 1811[4] and ferries for the Firth of Forth in 1814.[5]

Institutions for the maintenance of public order (law courts, prisons and police stations) were supported only if they were located in capital cities, with the exception of one small grant (less than £400) for repairs to a prison at Sheerness in 1810.[6] Edinburgh petitioned for £11,000 for a gaol in 1813,[7] which was granted,[8] but the Northumberland justices, when asking for a county gaol,[9] were left empty-handed. King's Bench, Marshalsea, Fleet and Millbank prisons obtained funds for repairs at very frequent intervals, and we have two payments to Jeremy Bentham, Esq., one jointly with another beneficiary for designs of penitentiaries in 1795,[10] the other amounting to £36,000 in 1799 for the " purchase of land and construction of a penitentiary ".[11] Law courts in Dublin,[12] Westminster[13] and Marshalsea[14] were supported, but Assizes in Cumberland in 1807[15] and Northumberland in 1809[16] pleaded in vain for court buildings. In the field of police, the forerunners of the Royal Irish Constabulary were already in existence in Dublin, but were not financed by votes of supply; three forms of police activity in London received grants between 1799 and 1815. Patrick Colquhoun impressed the authorities with *A Treatise on the Commerce and Police of the River Thames*; an Act of 1799[17] established a Police Office at Wapping manned by sailors discharged from the Navy.[18] From 1799 to 1813, the Police Office at Wapping (renamed Thames Police Office in 1800) received grants from Parliament. In 1802, seven " public offices " opened in London under the Middlesex Justices Act of 1792[19] received a grant for the first time[20]; subsequent grants were annual till 1815, though after 1804 they were voted for the " Bow Street Public Office ". In 1805, further enterprise in increasing the safety of London was rewarded when the first of many grants were made to the Horse Patrol[1] which the Chief Magistrate at Bow Street, Sir Richard Ford, had in that year instituted to patrol all main roads within a 20 miles' radius of Bow Street and to clear Hounslow Heath of highwaymen. It was staffed from retired cavalrymen.[2] Votes of supply for the Thames Police Office and the Horse Patrol discontinued after 1813, for the Bow Street Public Office after 1815. Even though there appears to have been something akin to a "Geddes Axe" in public administration around 1814, it is hard to believe that Parliament suddenly withdrew all financial aid from institutions which so materially contributed to the safety of its own members. It appears more likely that other methods were found of continuing the grants.

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[1] LVIII, 525.
[2] LX, 445.
[3] LXV, 117.
[4] LXVI, 349.
[5] LXIX, 31.
[6] LXV, 450.
[7] LXVIII, 373.
[8] LXVIII, 439.
[9] LXIV, 77.
[10] L, 266.
[11] LIV, 703.
[12] LVI, 252; LVII, 55; LVIII, 138.
[13] LX, 414.
[14] LXVIII, 46; LXIX, 421.
[15] LXII, 620.
[16] LXIV, 77.
[17] 39 & 40 Geo. III, c. 88.
[18] Captain W. L. Melville Lee: *A History of Police in England* (2nd ed., 1905), pp. 223–4.
[19] *Ibid.*, pp. 172–3.
[20] LVII, 596.

A remarkably large amount, over £1,000,000 between 1793 and 1817, was spent on the convict settlement in New South Wales. After the Luddite Riots had led to deportations, the expenditure on the settlement shot up from £48,000 in 1812[3] to over £80,000 in 1813,[4] after which it settled down to a steady £80,000 per annum. Whatever tendencies towards economy in public expenditure reduced other grants up to 1817, this outlay on the convict settlement was not changed.

The total disbursed in Great Britain under the heading of Religion, Ministers, Churches just exceeds the sum expended in Ireland (£930,000[5] as against £835,000[5]) ; this is due to the fact that from 1809 to 1816, £100,000 a year was paid to the Commissioners of Queen Anne's Bounty for the better maintenance of poor Church of England clergy.[6] This is financially the weightiest item, but Ireland provides a much greater variety of religious persuasions qualifying for support. There were Dissenting Ministers in Ireland (though they had their English counterpart, also receiving grants), Non-Conforming Ministers in Ireland, Seceding Ministers of Ulster (till 1805 described as "Presbyterian Ministers of Ulster and Munster"), the Board of First Fruits, which built churches and glebe farms in Ireland and between 1801 and 1817 received close on £500,000,

[1] LX, 144, 445.

[2] Lee: *op. cit.*, pp. 194–5. Lee says the Horse Patrol cost the Government £8,000 a year. That amount was never reached by votes of supply ; the highest for any year was £7,813 9s. 0d. in 1810: LXV, 118, 150.

[3] LXVII, 36, 237.

[4] LXVIII, 122, 134.

[5] Hundreds omitted.

[6] LXIV, 393; LXV, 466; LXVI, 408; LXVII, 510; LXVIII, 601; LXIX, 474; LXX, 428; LXXI, 478.

the Roman Catholic Seminary at Maynooth, always greatly concerned in its petition for a grant to stress its loyalty to the Crown, and last, but not least, the Association for Discountenancing Vice and Promoting the Knowledge and Practice of the Christian Religion, which started from small beginnings (the grant was only £276 18s. 6d. in 1801[1]), but in 1816 rendered services valued at £7,765 9s. 4d. by Parliament.[2] The most expensive single church building, from the public support point of view, was Henry VII's Chapel at Westminster Abbey, which received £28,365 4s. 3d. over the period 1807—1817; compared with this sum, grants of £5,000 for the St. Petersburgh English Church in 1814[3] and £2,000 for the English Episcopal Church at Rotterdam in 1815[4] pale into insignificance.

Under the heading of Science, Art and Education, expenditure of £759,000[5] for Ireland compares with £361,000[5] for Great Britain. To deduce the value attached to cultural institutions from the size of votes of supply would be, to say the least, a dangerous procedure: the English Protestant Charter Schools in Ireland between 1801 and 1817 received £477,000,[5] as compared with total grants of £239,000[5] in the period 1793—1817 to the British Museum. Yet apart from the English Protestant Charter Schools, there were three more Irish institutions obtaining funds for the purpose of elementary education: the Hibernian School (later Society) for Soldiers' Children, the Hibernian Marine Society for Sailors' Children, and the Society for Promoting the Education of the Poor in Ireland; total funds for these three in the period 1801—1817 exceeded £200,000. However slow the Government may have been in supporting elementary education in Great Britain, the condition and mood of the poor was a strong stimulant to speedier action in Ireland.

The British Museum started our period with modest grants of £3,000, which were not even annual; the Trustees made a new petition when their funds ran low. The 1793 grant[6] lasted them for three years, the 1796[7] and 1798[8] grant for two; only after 1800 was there an annual vote. However, at a period when the Elgin marbles could be acquired for as little as £35,000[9] and the Royal College of Surgeons were enabled by a grant of £15,000[10] to purchase the Hunterian

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[1] LVI, 253.
[2] LXXI, 364.
[3] LXIX, 421.
[4] LXX, 284.
[5] Hundreds omitted.
[6] XLVIII, 414.
[7] LI, 654.
[8] LIII, 492.
[9] LXXI, 440.
[10] LIV, 642.

Collection, the funds made available for the British Museum were not really as inadequate as they sound to us to-day. One of the earliest scientific institutions to obtain a regular grant was the Veterinary College, which received £1,500 per annum from its establishment in 1795 till 1806; the votes then tapered off, £1,200 being given in 1807[1] and £1,000 in 1808,[2] 1810,[3] 1811[4] and 1814.[5] In the intervening years, and after 1814, the College was self-supporting. In order to secure such continuous benevolence from Parliament in its early years, the College petitions never failed to stress the services which it rendered to the Army and their appreciation by cavalry commanders.[6] Another institution which received with great regularity an annual grant of £3,000 from its inception was the National Vaccine Establishment, opened in 1809.[7]

While, therefore, the conclusion is unavoidable that the prosecution of the war, safeguarding of food supplies and prevention of revolution in Ireland were uppermost in the mind of Parliament between 1793 and 1817, while its contribution to purely economic purposes by means of votes of supply is decidedly on the meagre side, we should not be justified in entirely disregarding the funds it voted for the improvement of the quality of life of the ordinary citizen. The modest trickle of such votes might not perhaps have attracted attention, did we not know that it was in the course of time to swell to a broad stream under the impulse of an ever-increasing sense of social obligation.

The London School of Economics.

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[1] LXII, 798.
[2] LXIII, 416.
[3] LXV, 387.
[4] LXVI, 408.
[5] LXIX, 114.
[6] E.g., LI, 667.
[7] For 1809: LXIV, 246.

Over-Employment[1]

By A. C. Pigou

A contrast is often drawn between situations in which there are more men available for jobs than jobs available for men and situations in which there are more jobs than men. In the former class of situation we have less than full employment, that is unemployment, in the latter more than full employment, that is overfull or, more briefly, over-employment. Of course, in actual life, where labour is imperfectly mobile, there may be unemployment in one part of the country or in one set of industries, and over-employment in another. But, with labour perfectly mobile, so long at least as there is no monopolistic action by work-people anywhere, this is impossible. That is the model case, for which the problem that I want to discuss stands out most clearly. This problem has to do with only one of the two situations contrasted above, that, namely, of over-employment.

Let us suppose ourselves to start with a situation in which employment is precisely full, with no unemployment and no unfilled vacancies. This implies that, if, at the ruling rate of money wage, additional men offered themselves, it would not pay employers to take on any of them, but all would become unemployed. With perfect competition this entails that the value of the marginal product of labour is everywhere equal to the money rate of wage; with any degree of imperfect competition—a degree which, for simplicity, we may suppose to be the same everywhere—that it exceeds in a determinable measure this money rate. Moreover, in the initial situation the system must not be in neutral or in unstable equilibrium. Where competition is perfect, that fact by itself excludes this possibility; where competition is imperfect a further condition is needed, with which we need not trouble ourselves. We wish to know in what circumstances an initial situation of precisely full employment will give place to one of over-employment.

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[1] This enquiry was suggested by the first chapter of Professor Ohlin's *The Problem of Employment Stabilization*, where over-employment is discussed, but in a quite different way.

It may perhaps be suggested that this will happen if aggregate money demand, which in precisely full employment is obviously equal to the value, at existing prices, of the current (net) supply of goods and services (including of course, entrepreneur services), comes somehow to exceed that value. But, as language is ordinarily used, aggregate money demand in any period is simply the sum total (net) of money that is paid for this current supply of goods and services. That is to say, it is the net money expenditure of that period; and this, looked at from the opposite side, is the value of goods and services (including entrepreneur services) forthcoming during the course of it. It is, therefore, *impossible* that aggregate demand in any period shall exceed the current value of these goods and services. No doubt it is possible, in the manner of Keynes's *Treatise on Money*, to get round this difficulty by defining income in a special sense, so that, when entrepreneurs receive anything in excess of their ordinary profits, the excess is not counted as income or reckoned as a part of the value of their services. But that seems to me a cumbrous and ineffective procedure.

It is better, as I think, to by-pass aggregate demand altogether and say simply that unfilled vacancies, or over-employment, emerge under perfect competition when the value of the marginal product of labour exceeds the money rate of wage by *any* amount, under imperfect competition when it exceeds it by more than a determinable amount. When this happens employers would gain by employing some more labour at the current wage, and, if any more labour were available, would therefore employ some more. Since *ex hypothesi* more labour is *not* available, there are unfilled vacancies or there is over-employment.

This seems simple enough; but there is a difficulty. Since, as we have seen, aggregate demand in any period is equal to the value of the goods and services forthcoming in that period, even when the value of the marginal product of labour exceeds, or, with imperfect competition, exceeds by more than a determinable amount, the money rate of wage, there is no spare or unused money income available, which might be spent on employing extra labour if there were any to be had. How then can it be true that employers in that event would employ extra labour, unless, indeed, the money rate of wage were reduced? The answer is quite straightforward. In conditions of over-full employment it would profit employers to turn over their balances faster than they are doing, provided that more labour became available; and the faster turning over of balances would itself create the extra expenditure, and so the extra income, that is required. Of course, after a sufficient volume of new labour had been absorbed to bring the value of the marginal product of labour to equality with—or, with imperfect competition, to the appropriate degree above—the money rate of wage, the position would become one of precisely full employment and any further labour offering itself at the current rate of wage would be unemployed.

What kinds of change then, if we suppose ourselves to start from a situation of precisely full employment, will be needed to raise the marginal product of labour relatively to the money rate of wage, and so bring about unfilled vacancies or over-employment? *First:* this will happen if, as against the initial position, the money demand schedule for output in the aggregate rises. This, in turn, will happen, if, other things being equal: (1) people's desire for output, whether for investment or for consumption, expands; or (2) their desire for liquidity contracts; or (3) the stock of money, in consequence, for example, of an influx from abroad or credit creations at home, expands. In a free economy any of these three kinds of change entails that the value of the marginal product of any given quantity of employed labour rises absolutely, and, therefore, the money rate of wage being given, that it rises relatively to that. In an economy, however, where all prices—or the main body of prices—are prevented by government regulation from going up, causes, which would normally push up the money demand schedule for output, will be frustrated, prices will not rise, and no gap between the marginal product of labour—or, under imperfect competition, the value of this marginal product plus something—and the money rate of wage will be created: and, consequently, except in a special case under imperfect competition,[1] no unfilled vacancies will be called into being. *Secondly:* a gap will arise, and so unfilled vacancies will be called into being, if, other things being equal, the money rate of wage asked for by work-people is reduced. *Thirdly:* if initially competition was imperfect and subsequently becomes less imperfect, this change will act in the same way as a cut in the money rate of wage in calling unfilled vacancies into being.

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[1] Conditions may be such under imperfect competition that, with a negatively inclined demand schedule, the system is in stable equilibrium, but when, as where demand increases but prices are prevented from rising, a horizontal demand curve is in effect substituted, equilibrium is rendered neutral. This could not, of course, happen under perfect competition since stability then, apart from external economies not relevant to the short period, requires the supply price in all firms to increase as output increases.

With over-employment brought about through causes that entail a rise in prices, that rise stimulates imports and checks exports. This tends to cause a drain on the country's reserves of gold and foreign exchange; in consequence of which the price rise must presently be arrested. When over-employment is due to a cut in wages or a decrease in the degree of imperfect competition, prices fall, and the opposite type of offsetting reaction is set up.

In any event, apart altogether from foreign reactions, no matter in what way over-employment is brought about, when it is present pressure from employees can hardly fail to evoke a fairly speedy rise in money rates of wages; so that, provided no further change occurs, over-employment will presently decline again to the simple full employment with which we are supposing ourselves to have started. Thus over-employment can only be maintained continuously for a substantial period provided that the causes which brought it about not only remain in action but themselves move forward continuously—the pursued keeping always a few steps ahead of the pursuer. The only cause that, practically speaking, can progress continuously in this way is an inflationary expansion in the stock of money. This implies in turn a continuing readiness by government to provide additional currency for the banks, since otherwise they would presently find themselves unable to encash valid cheques.

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Book Reviews

A Charter for World Trade. By Clair Wilcox. The Macmillan Company, New York. 1949. xvii + 333 pp. 33s. 6d.

This may be regarded as an authoritative statement of the case for the proposed International Trade Organisation from the point of view of the United States administration. Its author was Director of the Office of International Trade Policy in the Department of State during the preparation of the United States proposals on commercial policy, and he was leader or deputy-leader of the United States delegations at the three international conferences (at London in 1946, at Geneva in 1947, and at Havana in 1948) which hammered out the final draft of the I.T.O. Charter.

The Charter is considered by Professor Wilcox from the American point of view. In the best sense of the term this book is propaganda, being a statement by a leading American citizen why his fellow citizens should accept the Charter ; but in spite of this the book should be of interest to British students for at least two reasons.

First, it lays out clearly the contents and meaning of the Charter itself. The text of the Charter is appended to the book and is introduced by a three-page " Reader's Guide " which should help the student to find his way about that lengthy, involved, and turgid document. And Part II of Professor Wilcox's book itself, entitled an " Analysis of the Havana Charter " and constituting in length the bulk of his work, presents in the main a straightforward and objective description of the principal provisions of the Charter.

There are, however, certain passages where Professor Wilcox's accent differs from that which would be used by a commentator from another country. A striking example of this is the treatment of the relation between the International Trade Organisation and the International Monetary Fund in determining whether a country is justified in imposing import restrictions in order to safeguard its balance of payments. Import restrictions are likely to be extensively used on these grounds against United States exports and never to be used by the United States. To sell the Charter to the American public, therefore, it is desirable to emphasise (what is entirely true) that the use of these import restrictions is hedged round with many safeguards, including the fact that certain decisions about their use are to be made by the International Monetary Fund, on which the United States has a heavily weighted vote, and not by the International Trade Organisation, for which (unfortunately, in my opinion) the principle of ' one-State one-vote ' has been adopted. Accordingly in his summary of this all-important escape clause he writes (p. 183) :

" Import quotas may be imposed by a country that is found by the International Monetary Fund to be in balance-of-payments difficulty, during the period and to the extent necessary ' to forestall the imminent threat of, or to stop, a serious decline in its monetary reserves ' or ' to achieve a reasonable rate of increase in its reserves ' ".

But does not this skate rather too lightly over two facts the existence of which made these provisions acceptable to other countries? (i) It is not the I.T.O. or the I.M.F. or any international body which, in the first place, decides whether a country is justified in imposing import restrictions on these grounds. It is the restricting country itself. Another member country can then complain that the restrictions have been improperly imposed; and if the complaint is found by the I.T.O. to be justified, the offending country must either remove them or face the possibility that it will lose certain of the other advantages which it obtains under the Charter. (ii) While the I.T.O. must accept the opinion of the I.M.F. as to what constitutes a ' serious decline in monetary reserves ' or a ' reasonable rate of increase in reserves ', it is the I.T.O. which decides whether there is an ' imminent threat ' of a serious decline. Professor Wilcox's enthusiasm as an advocate in this case, as in one or two others, has, I feel, slightly distorted the meaning of the Charter which he so admirably succeeds in general in presenting.

But apart from its usefulness as a record of the facts, there is a second reason why Professor Wilcox's book should be of great interest to the British student. It reveals the general outlook on these subjects of the American " veterans of London, Geneva, Havana " (to quote from the dedication of the book) whose patient and effective efforts both at home in the United States and at the international conference table have done so much to bring the project for an International Trade Organisation up to the state of the agreed Havana text which now awaits acceptance by the Governments concerned.

What sort of a *Weltanschauung* is revealed? First and foremost one notes that Professor Wilcox is not one of those who in observing the not unnoticeable motes in the eyes of other nations fail to see the beam in the eye of their own country. In presenting the case for the Charter to his fellow-citizens he does not fail to emphasise the havoc wrought internationally by the Hawley-Smoot tariff of 1930 (p. 8); to stress the decisive importance to world trade of the maintenance of a high level of economic activity in the United States (pp. 32–34); to remind his readers that, quite apart from the tariff, there are a number of other measures in the United States which restrict international competition (p. 35); and to point out that in the ' free-enterprise ' United States a large sector of the economy, namely agriculture, is subject to the most extensive state planning (pp. 35–36).

But there are undoubtedly certain respects in which the general outlook of the American " veterans of London, Geneva, Havana " differs from that of some British veterans.

Let me take as an example the distinction drawn in the Charter between customs unions (which are treated as 'good') and preferential tariff arrangements (which are treated as 'bad'). Professor Wilcox (pp. 70–71) endorses this view. But how can it be reasonably maintained that to remove tariffs 100 per cent. between two countries, while maintaining them unchanged on imports from outsiders, will necessarily "make possible a more economic allocation of resources" whereas to remove them only 50 per cent. between the two countries "obstructs economy in production"? Certainly, a customs union *may* improve the allocation of resources (if its main effect is to make each partner in the union give up lines of production in which the other has a comparative advantage); but it may worsen the allocation of resources (if its main effect is to make each partner buy from the other partner products in which outsiders have in fact a comparative advantage). And is this not also true of a preferential area provided always that the preferences come into existence through the lowering of preferential rates and not through the raising of the non-preferential rates of duty? Either arrangement may be good or may be bad; but in any case neither is as good as a general all-round reduction of barriers by everyone.

There remains a central feature of Professor Wilcox's economic philosophy from which I personally would differ. He is inclined to put exchange-rate fluctuations into the same category with tariffs, subsidies, import restrictions and the like as evil instruments of economic nationalism which are to be avoided as far as possible (pp. 14 and 131). It cannot, of course, be denied that exchange depreciation may be used by a country in order to give employment at home by an expansion of exports and a contraction of imports when this is not in the least needed on balance-of-payments grounds. Safeguards against misuse of exchange depreciation are clearly necessary. But in a world in which countries adopt (as they certainly will and, in my opinion, certainly should) domestic measures to stabilise their internal level of demand for goods and services, difficulties which arise from time to time on the balance of payments can only be met either by direct control over imports and other payments or by allowing the exchange rate to depreciate. The moral to those who, in general, prefer the price mechanism to direct quantitative control should be obvious. My ideal world would be one in which (i) each country adopted a domestic financial policy for internal stabilisation; (ii) there was a minimum of barriers to world trade; (iii) governments refrained from intervention in the foreign exchange market in order to engineer abnormally low or high exchange rates; and (iv) external balance was achieved by exchange rate variations. But to work simultaneously for domestic full employment policies, free trade, *and* fixed exchange rates is to work for a system which cannot work. For these reasons I (in company persumably with Professor Wilcox) would like to see Article 21 of I.T.O. strengthened so that countries had less freedom to restrict imports on balance-of-payments grounds; but at the same time I would like to see Article 4 of I.M.F. weakened so that countries had more freedom to allow their exchange rates to find their own level.

But enough of this fighting over the old battlegrounds of the articles of the I.M.F. and the I.T.O., although I find that I have used only one tithe of the notes which I made in reading Professor Wilcox's book. It is not these points of difference of emphasis, but the solid basis of agreement, which is the really important point. As Professor Wilcox so rightly stresses (p. 188) the I.T.O. Charter is, of course, a compromise, as are all agreements among free peoples whose views differ in emphasis. How right Professor Wilcox is in his main theme that the Charter should now be accepted. Who in the United States can really believe that, if it were rejected, there would be any chance to re-negotiate a Charter which was more liberal? Rejection would, of course, merely result in a much less fettered growth of quantitative controls, restrictions, discriminations and the like. And who in the United Kingdom who pauses to think of our essential need to export less essential manufactures in order to obtain essential raw materials and foodstuffs can believe that a world without a code to limit protectionism all round could ultimately be anything but seriously detrimental to our interests?

J. E. MEADE.

The Pattern and Finance of Foreign Trade. Lectures delivered at the Institute of Bankers' International Summer School, September, 1949. Europa Publications Limited. 1949. 231 pp. 15s.

It is always difficult to review adequately a volume of lectures or essays by a large number of different authors on a wide range of topics; and this volume is no exception to the rule. These lectures are in general of a very high quality; they certainly deserve to have been published in book form; and a number of them should prove very useful in informing the student of the way in which this country's trade and international payments are organised in the post-war world. But with so many stimulating papers on so many different topics by so many distinguished persons it is difficult for the reviewer to do more than catalogue the subjects and lectures.

The volume includes two lectures of general economic interest about our present position by two eminent academic economists: namely Professor Sir Hubert Henderson's lecture on "The Emerging Pattern of International Trade" and Professor Hawtrey's lecture on "The Treasury, the Budget, Public Debt, and their effect on the Monetary Situation". The former is a persuasive plea for the *combined* use of disinflation, the price mechanism, and direct quantitative controls (including discriminatory import restrictions) to deal with our pressing balance-of-payments problems; and in the latter Professor Hawtrey analyses the relationship between income, outlay, the supply of money, the budgetary surplus, and the national debt in order to emphasise the central rôle which, in his opinion, a redundant supply of money has played and is still playing in our economic difficulties.

But what to the student of economics is likely to prove the most useful part of the volume is a set of five lectures about the post-war methods of conducting our trade and payments. This group comprises Mr. Harold Wilson on "International Trade Agreements," Mr. Paul Bareau on "British International Payments Agreements," Mr. Manning Dacey on "Inter-European Payments," Mr. O'Brien on "The Technique of the United Kingdom Exchange Control," and Mr. Marcus Fleming on "The I.T.O. Charter—Proposed Rules of International Trade." The student who wishes to obtain an informed conspectus of the salient facts regarding the way in which this country's trade and payments are at present carried out or about the implications for our trade and payments of the I.T.O. Charter could not be better advised than to start by reading these lectures. Each lecturer is a recognised expert upon his subject, and each has succeeded in making the main facts clear and in bringing out their chief implications.

There remain five other lectures. In his lecture on "The Place of United Kingdom Shipping in Foreign Trade," Professor M. G. Kendall gives a concise and useful summary of the main statistical facts concerning the size and composition of the United Kingdom fleet, the geographical distribution of our shipping activities, and the importance of shipping in the foreign balance of various countries. Mr. Megrah gives an able discussion of a problem which is of interest rather to bankers and lawyers than to economists in his lecture on "Some Aspects of the English Law of Documentary Credits." Two important sets of institutions in the City of London are described in Mr. Lionel Fraser's lecture on "Issuing Houses and the Raising of Long-Term Capital in London," and in Sir Philip D'Ambrumenil's lecture on "The Organisation and Functioning of British Insurance;" and Mr. Leslie Gamage lectured on "British Export Policy and Practice."

The Institute of Bankers is to be heartily congratulated on having provided so able and so informative a set of lectures on the present position of our arrangements for foreign trade and payments.

J. E. Meade.

Labour. By P. Sargant Florence. Hutchinson's University Library. 1949. viii + 230 pp. 7s. 6d.

This interesting little volume is a somewhat unusual and even venturesome contribution to the study of labour. It treads and in fact often crosses, the boundaries of non-economic "sciences" treating of the factors which influence the composition of the labour force and its output. These factors are naturally of interest to the economist and on the whole Professor Florence strikes a fair balance in his discussion of them.

The basic postulate of the first parts of his book is that everything in the field of labour productivity happens finally through the human factor. This point is doubtless very simple and very trite but there are surprisingly many people who tend to forget it. Professor Florence goes on to describe and comment on the many influences which play on the labour force. He shows, perhaps, too much confidence in the measures of some of them and there is a mysterious passage about the spectrum on page 24.

There is no doubt, however, that much scope exists for the study of methods of raising labour productivity through better layout of jobs, elimination of waste movements, the improvement of the wages structure, and the better choice and training of labour. On all these points Professor Florence has stimulating things to say. It is precisely some of the psychological factors which he describes, however, which are very likely to prove stumbling-blocks to what he would like to see come about. For a long time, the economic life of Britain has been enfeebled by a certain resistance to change. There have often been very understandable reasons for this resistance; the fear of losing jobs because of new machines and the restrictive business mentality bred from unstable economic conditions, have contributed to the weakening of enterprise. Furthermore, many of the actual conditions which have had so bad an effect, are yet to be overcome; the shortage of housing is a good example.

The question of greater efficiency is recognised as fundamental to the British economy and Professor Florence has made a valuable contribution to the study of that question. The later parts of the book, particularly those dealing with the problem of employment and unemployment (theoretical and policy problems), are very brief and much less satisfactory. The best parts of the book are those which deal with matters such as those outlined above.

A. L. MINKES.

The Evolution of the Zollverein. By Arnold H. Price. Ann Arbor, University of Michigan Press. London: Geoffrey Cumberlege, Oxford University Press. 1949. xi + 298 pp. $3·50.

Two big powers and a multitude of smaller states desirous of forming a "Third Force" and reflecting whether a customs union would add to their strength; the largest among the small fry deciding against union with a number of petty and unimportant States because they would not really increase its weight, merely obtain a voice in determining common legislation; the formation of small regional customs unions—it all sounds as if we were talking of the Fritalux and Britscan projects of our own day. However, the scene is Germany, the period the second and third decades of the 19th century, and the discussion on the background out of which grew the German Zollverein.

Dr. Price has deliberately limited himself to two particular aspects of his subject :—the institutional framework required and the influence of contemporary political thought. The reviewer cannot but regret this limitation. The technical intricacies of legislation and administration are of interest to tariff specialists, but make little appeal to the general reader. The influence of political thought is a more rewarding pursuit, though even Dr. Price's painstaking researches do not result in a clear picture. This is hardly his fault. In most fields of thought, early 19th century Germany was fascinated by paradox :—Romantics practised excessive self-indulgence in their private lives, until suddenly becoming converts to Catholicism ; literary circles, while professing admiration for Goethe, listened simultaneously to the ravings of a semi-literate physical training instructor (not a house-painter that time, nor Austrian-born !) who indoctrinated them with the superiority of their nationhood ; the idealist philosophy of world citizenship underwent a remarkable metamorphosis in the mind of one of its German devotees, emerging as a theory of history taught for the purpose of national self-glorification. A customs union is simultaneously an extension of free trade (within the fence) and a device for increased protection (against outsiders) ; this commonplace of present-day economics was a novelty to the undeveloped German economic thinking of 125 years ago and made a powerful appeal to the German love of the paradox. German thinking of the period resembles nothing as much as a kaleidoscope which you shake and shake ; all colours are represented, yet no pattern emerges.

Dr. Price shows in detail how the idea of customs union meets with much resistance, how and why it slowly conquers one State after another, until it is put into practice, first regionally, finally throughout most of non-Austrian Germany. A point of great interest is that Prussia, the chief participant in the drama, was unwilling to consider customs union while her budget was unbalanced. Present-day statesmen look to customs union as a cure for a passive balance of payments. Only when Motz, Prussia's new Minister of Finance, had balanced the budget by internal reorganisation in 1828, was he willing to entertain union proposals—a move from strength, not from weakness. Dr. Price takes great trouble to allot credit to each German statesman for his contribution to the elaboration of a functioning system of customs union ; where there are rival claimants to the origin of an idea, the soundness of their titles is investigated in great detail. Can it be that, in reading much German history, Dr. Price has come to adopt a rather German attitude towards his material ? To the biographers of individual administrators, this aspect would be of much importance ; it impresses the general reader as a contest for the award of the highest marks to the cleverest boy.

At this point, we regret Dr. Price's self-denying ordinance. Instead of deciding on the exact merits of administrators, we would rather know more about the general economic background, on which there is disappointingly little, except *passim* in the first chapters. How strong were the economic forces pushing the German States, so anxious to retain their sovereignty, towards customs union which implied sacrificing some of it ; how far did the transport system in the pre-railway age improve, outmoding the ridiculously small enclaves (some, as Dr. Price tells us, containing less than 1000 inhabitants) ; how quickly was distribution of goods transferred from town fairs to more modern outlets ; to what extent did the removal of cumbersome customs barriers increase inter-State trade ? Dr. Price mentions the standardisation of coinage, weights, measures and toll charges—all economic corollaries of customs union ; but he touches only on phenomena which are laid down in agreements or form part of the administrative system.

This book will be of value to the customs administrator, particularly if he is concerned to prepare a scheme for a Western European customs union, and to the political historian. The economic historian will find his appetite whetted for a book Dr. Price meant to write on the Zollverein (as he tells us in the preface), but has not yet written. Should he turn to that task now or prepare the present book for a new edition, could we make an urgent plea, on behalf of readers not thoroughly familiar with German geography, for the inclusion of a political map of Germany after 1815 ?

WALTER M. STERN.

Farm Accounts. By F. SEWELL BRAY and C. V. DAWE. Oxford University Press. 1948. xl + 149 pp. 15s.

For nearly a century-and-a-half, until as recently as 1941, the British Income Tax Acts gave official recognition to the fact that " farmers do not keep accounts ". For from the very beginnings of the income tax in 1799 a farmer's income was always assessed on an arbitrary basis, being assumed to be equal to the rental value of his land or some fraction or multiple of this value. It is true that from 1851 farmers had the right to be assessed on their actual income where this was less than the normal assessment ; but since the general level of Schedule B assessments was from time to time changed to accord with the level of agricultural prosperity, the ascertainment of a farmer's actual income was necessary only in somewhat exceptional circumstances.

These taxation arrangements have naturally not tended to encourage the development of farm accounting, while the paucity of joint stock companies engaged in agriculture has also sheltered the industry from the accounting requirements of the Companies Acts. Recent developments in income tax have, however, changed all this. The Finance Act 1941 started and that of 1948 completed the transfer of the taxation of farm income from Schedule B to Schedule D, so that now, by section 31 of the Finance Act 1948, " all farming in the United Kingdom shall be treated as the carrying on of a trade, and the profits or gains thereof charged to tax under Case I of Schedule D accordingly ". For tax purposes, therefore, if for no other, farmers are now under the same necessity to keep accounts as other traders.

The publication of a comprehensive, if compact, work on farm accounts is therefore timely. Messrs. Bray and Dawe offer the fruits of a most promising collaboration between an accountant and an agricultural economist, and their work appears under impressive auspices, being sponsored by the Incorporated Accountants Research Committee, recommended to farmers by a spokesman of the National Farmers' Union and introduced by Professor Ashby of the Agricultural Economics Research Institute at Oxford. In view of such powerful backing, any critic must feel the need for circumspection.

The book is divided into four chapters, which are devoted respectively to the farmer's accounts, his costs, his relations with the agricultural economist and his relations with the professional accountant. The accounting system which is recommended is based on the Farm Account Book devised by the Department of Agricultural Economics of Bristol University. This is a combination of statistical records, inventory valuations and ledger accounts which, together with the farm cash book and private ledger, should give all the information necessary for the preparation of the farmer's revenue accounts and balance sheet. The Farm Account Book is reproduced in an appendix to *Farm Accounts*. It is a practical and well-tried system, the widespread adoption of which would certainly raise the standard of farm accounting.

Yet very soon the reader finds himself asking for whom it was that *Farm Accounts* was written. The foreword, it is true, makes it clear that " it is intended for the farmer rather than the accountant ". Yet one suspects that the authors have tried to appeal to agricultural economists and accountants at least as much as to farmers, and as always happens in such cases, they are liable to end by pleasing nobody.

It is in the chapter on " Farm Costs " that the attempt to please everyone fails most signally; for the discussion of the many difficult problems which arise will probably be too obscure for the farmer and too superficial for the more expert reader. Costing is a technique which is more easily adapted to the relatively straightforward processes of factory production than to the complexities of farm life. A farm, after all, is more than just an economic unit. It is somebody's home and way of life. And even from a purely economic viewpoint, it bristles with accounting complexities. Joint products are the rule rather than the exception, and most of the things the farm produces are intermediate products as well as end products. How, if at all, to divide the cost of growing wheat between the cost of grain and the cost of straw ? How to arrive at the separate cost of horse labour, and of home grown animal feeds, when the cost of each is a cost of the other ?

It must be admitted that our authors make a gallant attempt to grapple with these problems, aided by liberal doses of what one writer on this subject has called " the philosophy of ' as if ' ". Thus, the farmer's own labour must be valued as if he were his own highest-paid employee. The cost of grazing his horses in his own fields must be reckoned as if he were paying a neighbour for grazing rights. And so on. Yet the serious weakness in the discussion of farm costs is not that there is too much of the " as if " philosophy but too little. For valuation " as if " does correspond to something real—it corresponds, as nearly as may be, to opportunity cost. It is when this procedure is abandoned in favour of arbitrary allocations of money outlay that the discussion gets into deep water.

It may be worth quoting one or two instances of this predilection for arbitrary allocations—a predilection which runs through so much of the literature of cost accounting. Thus, on p. 62, there is a discussion of the treatment of crop costs. " From a strict cost accounting point of view one has no option but to divide the total costs between the grain and the straw, and this is usually done by the arbitrary method of dividing the costs in proportion to their respective feeding values." This may be usual, it can hardly be useful. There is certainly a more desirable method than this, even from " a strict cost accounting point of view ", and that is to charge both grain and straw to any subsequent processes at their current values, the profitability of wheat growing being judged by comparing the total value of grain and straw with the cost of growing wheat.

Again, " the allocation of total costs between sugar-beet roots and tops is another problem of the same nature. If it should be decided to charge no costs to the tops, but all to the roots, then when the tops are fed to stock they *must* be fed free, and not at so much per acre or per ton." (Reviewer's italics.) It is bad enough that such a futile and arbitrary calculation as the division of beet costs between tops and roots should be made at all: but it is even more serious that the result of this calculation should distort many other farm costs, and eventually falsify the statistical totals built up by agricultural economists from such information.

It would be unfair to make too much of these weaknesses, or to underestimate the constructive nature of much of the book. Moreover, the scope of the book is somewhat wider than the title might suggest, and the chapter devoted to the relations of the agricultural economist with the farmer gives an insight into the use made by the economist of accounting data collected from farmers. Even if some of the earlier discussion has suggested that the more detailed information is not always as reliable as it looks, it is clear that some useful work is being done in providing regional averages against which the individual farmer can compare his own figures. Some of these comparisons—of the wage bill per acre, for example—could hardly be vitiated by the accounting idiosyncracies of individual farmers. Yet in other cases where, for instance, unit costs of particular products are being compared, it can only be hoped that distortions caused by arbitrary accounting procedures tend to cancel out. That this may not be true seems nowhere to be sufficiently recognised in this book. It is surprising, to say the least, that whereas in other industries cost comparisons have followed in the wake of a uniform accounting system, in farming alone the comparisons seem to have come first, and the uniformity of accounting method later or not at all.

David Solomons.

Changes in the Cost-of-Living and the Distribution of Income since 1938. By Dudley Seers. Oxford University Institute of Statistics. Oxford: Basil Blackwell. 1949. 84 pp. 6s.

These five essays record an interesting series of manipulations of, and inferences drawn from, standard statistical data.

The official estimates of national income and expenditure record details of total expenditure on consumption in 1938 and the first essay divides these items of expenditure into purchases by the working class and purchases by the middle class, the latter being also tentatively divided again into purchases by the lower and upper middle class.

Mr. Seers assumes that the working class budgets, collected by the Ministry of Labour in 1937–8, modified for an obvious under-declaration of drink and tobacco, indicate sufficiently accurately the distribution of expenditure by about 84 per cent. of the population whose total expenditure is independently estimated. This 84 per cent. is called the working class and includes salaried workers who earned less than £250 in 1938. The expenditure on specific groups of commodities of the remaining 16 per cent. of the population can thus be estimated by subtraction. Only for oils and fats and for dairy produce does this method yield obviously incorrect results; they are obviously incorrect because they show the working class as purchasing more than the total supply. The errors may be either in the official estimates of total household expenditure or in the budget records. It must be difficult even for the Government to estimate pre-war household purchases of oils, fats and dairy produce including eggs accurately, for a proportion of each of these commodities was purchased by caterers and food processing firms, including bakers and confectioners, many of whom were small. Some of the relevant information may have been obtained by the Ministry of Food by direct questions to firms and caterers when these guessed that allocations would be made on the basis of pre-war use. Clearly there was uncertainty in the official estimates for these two groups of commodities, for, as Mr. Seers points out, the official estimates for 1938 were altered during 1947 by 20 per cent.

In the second and third essays index numbers of the current money cost of making pre-war purchases appropriate to the working and middle classes are calculated. For the working class index the basis for the calculation is the " weights " used in the 1947 interim index of retail prices, for these weights are appropriate to the quantities indicated in the 1937–8 budget survey. Thus if the weight of one commodity has increased then the price of that commodity has increased more than the general increase. If the increase for that commodity is known then the general increase can be calculated.[1] The official estimates of national income and expenditure give a price index for total expenditure on consumption so that, given working class expenditure represented 55 per cent. of the total in 1938, and given the index appropriate to the working class, the index appropriate to the middle class can be calculated.[2]

Habits of expenditure have changed since 1938, so that quantities appropriate to 1938 are not appropriate to 1947, though in fact used in the interim index of retail prices. The fifth essay considers whether this makes the index of retail prices an unsuitable index to use now for measuring changes in the working class cost of living. The conclusion is that though some of the " weights " are wrong there is no noticeable correlation between wrong weights and abnormal price changes, so that up to the time of writing the index was a satisfactory measure of working class cost of living from mid-1947.

The other essay, the fourth in the book, though making some use of the results described in the other essays, is different in character and is a commentary on the official estimates of national income and expenditure. Such estimates and comments always seem to present problems of how the recorded changes can be explained by economic theory. In this essay, for instance, an adjustment is made because current replacement costs of fixed assets exceed original cost upon which depreciation is calculated. The adjustment, however, is lower than usual, and this is largely because allowance is made for under-maintenance and war destruction which are estimated to have left our fixed assets in 1947 about 10 per cent. lower than they had been

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[1] *For example*, the Ministry of Labour budgets (modified for drink and tobacco) indicate that in 1937–8 out of every 100 pence spent by the working classes 3.37 pence was on bread. The Ministry of Labour cost-of-living index showed that the price of bread rose from 161 per cent. to 178 per cent. of July 1914 between 1938 and June 1947. Therefore the amount of bread purchased for 3.37d. before the war would cost $3.37 \times \frac{178}{161}$d. in June 1947. The interim index of retail prices indicates that by June 1947 this expenditure represented only 2.30 per cent. of expenditure necessary to retain 1938 working class consumption. Therefore, what cost 100d. in 1938 would cost $3.37 \times \frac{178}{161} \times \frac{100}{2.30}$d. $= 162$ pence in June 1947. The working class cost of living had therefore increased by about 62 per cent.

[2] If when 1938 = 100 the 1947 aggregate price index = 168½ and the working class index = 161½ with 55 per cent. of the expenditure in 1938 being by the working class we have the middle class price index in 1947:

$$= \frac{168\tfrac{1}{2} \times 100 - 161\tfrac{1}{2} \times 55}{45} = 177$$

In addition to introducing refinements, Mr. Seers works out index numbers for groups of commodities.

in 1938. When considered in relation to production we would expect that with less fixed capital and more people working the output per unit of capital would increase. It is interesting to note that in addition output per unit of labour also increased, and this is even remarkable when we remember that labour was supposed to be tired and that in mining and building, output per unit of labour was lower than before the war. These results, however, are consistent with the evidence of the interim index of production which shows that compared with before the war, labour cost increases have been least for those commodities of which production increased most—itself a curious result in a period of inflationary expansion.[1]

If output per unit of both capital and labour is increased when the amount of capital is reduced, it would be interesting to speculate how much of this is due to economies of working plant near to capacity and to wonder how much current capital formation, in increasing capacity, will lower recorded efficiency. At present, for instance, we are increasing electricity generating capacity in order to meet occasional peak demands, other demands being satisfied already. It seems certain that this will reduce output of electricity per unit of capital, and it may reduce it per unit of labour because casual employment of labour to meet peaks of demand is not normally efficient and in times of high employment may not be possible.

Another point which strikes one from these figures is the smaller proportion of national income compared with before the war shown as received in the form of salaries. Yet in many, if not nearly all, industries we have evidence that the proportion of salaried earners has increased—this is shown in the 1946 partial census of production, in the figures issued by the iron and steel federation and in the number of civil servants, though partially balanced by a decline of employment in distribution, including presumably "salaried" shop assistants. Whilst people are so willing to swell the ranks of salaried workers it is difficult to argue convincingly that in the aggregate these people are being unfairly treated, no matter what the figures in the official estimates show.

H. S. BOOKER.

Distributive Trading. An Economic Analysis. By Margaret Hall. Hutchinson's University Library. 1949. 7 + 203 pp. 7s. 6d.

This is an amazingly comprehensive book. Within its 200 pages it attempts to cover the main patterns and problems of distribution in Great Britain and the United States. Indeed, its width of coverage is its undoing. It is impossible to cater for all readers in a book of this size, and the attempt will leave unsatisfied both the beginner and the more advanced student.

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[1] See *Studies in Official Statistics*, No. 1. "The Interim Index of Industrial Production", p. 45, paragraph 53—"In industries . . . in which output has increased, relatively to average change in output, wages per unit of output have, in general, shown a relative decline, and *vice versa.*"

Any reader not familiar with the concepts of economic analysis will be constantly bewildered by the use of terms, the definition of which is either deferred until a subsequent page, or omitted altogether. When he reaches page 114, he will find that Mrs. Hall's description of the ordinary man applies exactly to himself. " He has received years . . . of indoctrination in the theory that competition is a virtue . . . but the definition of competition has not been revealed to him." If he has successfully constructed some of the conditions of perfect competition from the numerous hints scattered throughout the book, he will then find himself completely mystified by the diagram on page 143, which attempts to compare competitive and monopolistic price and output. He will be unable to find any trace of the horizontal demand curve which he has been led to expect under perfect competition. Can it be that the demand curve shown here is both the sales curve of a single monopolist, and the market curve facing several producers ? If this is indeed so, what is the precise meaning of the marginal cost curve shown here ? He must solve his problems himself.

Meanwhile, the more advanced student will be at least as unsatisfied. He will feel that a subjective demand curve would be more appropriate to an analysis of the problems of monopolistic and oligopolistic markets, and he will suspect that the theory of normal profits, even in the modified form adopted by Mrs. Hall, does not adequately explain entry into retailing.

Nor will he be entirely satisfied with the treatment of selling costs. " So long as (marginal cost) is less than the marginal revenue for the sale of any article, it will pay to lower its price and expand sales. When the two are equal, it will not pay to lower prices any more. But at this point it will pay the retailer to spend more on selling costs and attract extra customers until the net gain from the sales to them . . . is just balanced by the extra costs." I suspect that a more satisfactory treatment would have resulted if Mrs. Hall had followed up her suggestion on the preceding page that the retailer can attract customers either by lowering price, or by, in effect, altering the basic commodity. A simple explanation can then be derived on the lines of Professor Chamberlin's analysis of the individual firm and group when account is taken of the fact that our proprietor can produce a number of different commodities, having different cost schedules. The very difficulty of differentiating between selling and production costs seems to make this kind of treatment analytically more pleasing. Admittedly the usual diagrammatic representation of this situation has many drawbacks, but it is not essential to a description of the process.

At the beginning of the book, Mrs. Hall poses two questions. (1) How much can we, as a nation, afford to spend on distribution ? (2) Are we getting our money's worth from our expenditure ?

The first question is a timely reminder that we cannot think of the costs of distribution in absolute terms. The suspicion, perhaps in time the knowledge, that seven shillings of every pound we spend is swallowed up in distribution costs, is of little significance taken by itself. Mrs. Hall is to be congratulated on her excellent explanation of the theory of opportunity cost, and on her application of the doctrine to this particular question.

The search for an answer to the second question leads to a consideration of retail and wholesale outlets, advertising, resale price maintenance, trade associations, and wartime and post-war controls. One may not agree with some of the conclusions in the body of the book, but the arguments are fairly set out, and well substantiated with such figures as are available. In addition the reader, whose interest has certainly been aroused, is provided with an excellent short reading list as a basis for further study.

JULIA HOOD.

The Lagan Valley, 1800–50 : a Local History of the Industrial Revolution. (*Studies in Irish History.* Vol. 3.) By E. R. R. Green. Faber. 1949. 188 pp. 16s.

Mr. E. R. R. Green, formerly a lecturer in history in Trinity College, Dublin, has studied the development of the one district of Ireland which felt the Industrial Revolution as something more intimate than a cross-Channel source of employment or market for grain. In Belfast and its hinterland coal and iron were not to be found and shipbuilding was yet to come ; it is, therefore, with the manufacture of textiles that Mr. Green's chapters on industry are concerned.

The Lagan valley, for a few decades, lamely jogged behind Lancashire in the mechanisation of cotton-spinning ; the stimulus came partly from the influence of Grattan's protectionist policy in quickening native enterprise and attracting British capital, and partly from the transfer of resources from a temporarily depressed linen industry. Alone among the industries of Ireland cotton continued after the Union to receive protection. The withdrawal of this in 1824 added critically to troubles which had always prevented Irish yarn from finding an overseas market. British competition was the great bogey, especially in times of depression, when it might reasonably be termed ' unfair '. Second to this was the dependence of the Lagan valley industry upon that of Lancashire : machinery, raw materials and skilled workers (too many of them belying their description) all had to be brought to Ireland across the Channel. With melancholy symbolism this chapter of Irish economic history ended in several of the cotton factories being transformed into poor law institutions and in the hand-loom weavers becoming degraded outworkers for Scottish firms. The one valuable legacy was that cotton helped to provide the longer established linen industry with the incentive and the means to make itself internationally competitive. To a large extent it was the competition of cotton, British as well as Irish, which made the power spinning of flax a matter of urgency. That it was not yet another neglected matter of urgency was partly because the cotton factories had attracted a working population to Belfast and trained it in the skills and habits of factory work, and had made Belfast itself both a commercial centre and the home of men with some experience in organising factory industry.

The move towards the mechanisation of flax spinning derived force from within the linen industry as well as from without. Mr. Green shows, in a convincing fashion, how a leading theme in the development of the domestic linen industry in the decades after 1780 was the strengthening of the position of the increasingly capitalist bleachers and their eventual assumption of control over the industry. Traditionally, drapers had attended the local brown-linen markets and bought cloth which they arranged to have bleached, finished and sent to Dublin to the English merchants. Because of technical changes, small men who had combined bleaching with farming and weaving were forced to give up. Their place was taken by men of substance who had sufficient enterprise and resource to by-pass both the drapers and the Dublin merchants; they bought direct from the weavers and exported to England direct from Belfast. Enterprising though they were, they did not prevent the coarse-linen trade from slipping through their fingers to be engrossed by power spinners in Yorkshire and Scotland. When the rest of Ireland thus lost its linen manufacture the Lagan valley had cause to be grateful to Crommelin and his Huguenot colony who had introduced fine-spinning techniques in the seventeenth century. The years after 1825, when fine counts could first be spun by power, were a critical time for Ulster industry. It was then, while cotton was being submerged, that it was able to be of lasting importance as a model for the reorganisation of linen; it was then that the bleachers, afraid for their position if fine spinning should go the way of coarse work, put their capital into spinning machinery.

The coming of power spinning meant a catastrophic fall in the income of hand spinners. Nor, as when cotton was first spun by machinery, was there a compensating flush of prosperity for the weavers. No longer able to find their yarn locally they became outworkers for the spinning mills or for the merchants who bought the yarn in bulk. Until after the Famine, however, they were able to hold their ground in output if not in income because, living largely on the potatoes and oats they grew themselves, they could accept something less than a subsistence wage as a means of undercutting the machines. In the early forties they began to be gathered together in factories and in the mid-forties, when famine and fever thinned the population and wages began to rise, the factories went over to power looms.

The appeal of the rest of Mr. Green's book is more exclusively to the Irish historian or even to the local historian. There is an introductory chapter, both historical and geological, and there are chapters on communications, agriculture and population. With Belfast succeeding Dublin as the commercial centre of the linen trade, and with spinning mills becoming concentrated there, the Lagan valley assumed new importance as a channel of communications. A short canal, deriving part of its funds from beer and spirit duties, was built from Lough Neagh to Lisburn and the river was made navigable from there to Belfast. Never particularly successful either to its shareholders or users, the navigation was reduced by the opening of the Ulster Railway in 1842 merely to the haulage of coal to a rural population that lacked turf. The linen industry, combined though it was with farming, did not insulate the agriculture of the valley from the trends common in the rest of the country. Indeed, in some respects it made them more keenly felt ; the fragmentation of holdings was furthered by the partial dependence of the peasantry on industrial earnings ; their divided interests tended towards careless cultivation and the small size of their holdings induced them to keep an excessive area under tillage.

Mr. Green tends at times to be too generous in the amount of detail he offers his readers and, in his chapter on population, he dismisses over-hastily the social developments that accompanied the industrial changes. None the less, his careful study, for which he has combed the Ordnance Survey Memoirs as well as the parliamentary papers, the travellers' accounts and the statistical surveys, will be valued by those interested in either Irish history or the history of the Industrial Revolution. The book contains an index, a bibliography and half-a-dozen maps.

K. H. Connell.

SHORTER NOTICES

Economic Principles of the Greenland Administration before 1947. By P. P. Sveistrup. Meddelelser om Grønland, Vol. 150, No. 1. Copenhagen. 1949.

This book is concerned with the price policy that has been followed and that which ought to be followed by the Royal Greenland Trading Company. The author starts by showing that Greenland's economic structure is such that export prices fluctuate far more violently than import prices, and concludes that since imports are necessary for existence a trade monopoly which stabilises prices and thus isolates the Greenlanders from the trade cycle is desirable. He goes on to consider various other reasons why import and export prices (plus and minus transport and distribution costs) should not equal world prices, in particular the low time preference or foresight of the Greenlanders. The subject matter is interesting, but there is a good deal of irrelevancy, and some passages are almost incomprehensible. This is partly due to poor translation and even more to the misuse of economic terminology by the author. A considerable amount of space is devoted to a survey of earlier discussions with regard to the trading monopoly and much incidental information is given. It is interesting to note (p. 146) that in 1935 hospital accommodation per head of population was much greater in Greenland than in Denmark, although on the other hand Greenland possessed only one dentist.

Inflationary and Deflationary Tendencies 1946–1948. United Nations. 1949. II, A. 1. Obtainable through H.M.S.O. 52 pp. 2s.

After a very brief summary of developments in the last two years, this report gives a survey of the theory of inflation. Although technical terms are eschewed, this section is too concise to suit non-economists. It is nevertheless very competently written and forms a useful summary of the modern approach. In harmony with this exposition the last and main part of the report surveys the development in a number of countries in terms of (*a*) the changes in the ratio of net non-consumption payments to income, (*b*) the changes in the proportion of income which tends to be consumed and (*c*) the changes in gross real income *per capita*. (*b*), of course, must be interpreted *ex ante*, and the factors considered under this heading are mainly pent-up consumption demand and changes in income distribution. Factor (*a*) does not take into account the expansionary effect of a balanced budget increase, although a footnote in the theoretical section mentions this phenomenon. The analyses of the course of events in different countries are too short to be really interesting and could have been much better had the authors been allowed to refer to non-official sources and discussions.

Price Control. Government Intervention or the Free Market. By F. R. J. JERVIS. Hutchinson's Scientific and Technical Publications. 1949. 224 pp. 8s. 6d.

This book is a criticism of various forms of State interference with the price mechanism. It begins with an elementary summary of the theory of supply and demand and monopoly prices, while the following chapters, which constitute the bulk of the book, discuss successively such matters as Agricultural Marketing Boards, control of retail prices, bulk buying and so on. The last chapter, though admitting that they may be necessary during the transition period, contains a general onslaught on Government controls.

Throughout, Mr. Jervis puts a very proper stress on opportunity cost, the fact that demand is not independent of price and other essentials, so that although presumably written primarily for the layman, his book stands in refreshing contrast to many recent writings and speeches. The chapter on housing in particular is a good exposition of how the price mechanism could work and how it is stifled. Similarly, the chapter on the control of profits contains some useful debunking of political fatuities.

At various points there are ambiguities which could mislead some readers. The definition of marginal cost as " the cost of additional production " (p. 27) is not entirely clear, while to say that " The post-war inflation of the currency by putting more money into circulation has caused prices to rise " (p. 104) is either tautological or else requires further explanation. Nor can one accept the generalisation (p. 107) that freezing some prices and increasing others by taxation involves a conflict of policy. Furthermore, Mr. Jervis has ignored some matters. In his anxiety about Government controls he does not sufficiently stress the objections to price maintenance by trade associations, so that many readers may get the impression that the absence of controls is all that he desires in spite of his protestations in the concluding pages. Nor is he always quite fair ; if the Cotton Commission's cover scheme is an inadequate substitute for hedging on the Exchange this ought to be explained, and the case *for* nationalisation of transport is hardly considered.

In spite of these defects, Mr. Jervis' book is a useful though light-weight discussion of important problems.

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Uniform Cost Accounting—A Survey

By David Solomons

Part I

In much that has been spoken and written about post-war industrial reorganisation in Great Britain, frequent references can be found to the desirability of promoting the development of uniform costing schemes in industries for which none have yet been devised, and of getting them more widely adopted in industries which already possess them. Perhaps no other excuse need be offered for attempting at this time to survey and evaluate the existing uniform costing schemes in this country than that a study of them may help to put into perspective some of the current discussion about their further development.

What Uniform Costing Is

Uniform Cost Accounting has been defined by the United States Chamber of Commerce in terms which have gained wide acceptance:

" Uniform Cost Accounting comprises a set of principles and in some cases of accounting methods which, when incorporated in the accounting system of the individual members in an industry, will result in the obtaining of cost figures by the individual members of the industry which will be on a comparable basis."[1] The trouble with this definition is that it says too much. It is by no means self-evident that the cost figures which different firms show, under a uniform costing system, really are on a comparable basis. I shall return to this point later. But because it is easier to agree about what uniform costing is than about what it does, it seems preferable to define it simply as the formulation of an agreed set of cost accounting definitions and conventions for adoption by all the firms in a particular industry.

This definition, of course, answers one question only to raise another—what is an " industry " ? If it is true that

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[1] *Uniform Accounting Activities of Trade Associations* (Dept. of Manufacture of the U.S. Chamber of Commerce, M.A. 801–804).

" product differentiation robs the concept of industry of both its definiteness and its serviceability. Outside of the limiting cases of pure monopoly and pure competition, the substitutability between any two products, the competitiveness between any two firms varies only in degree. The grouping of firms into industries cannot be based on any clear-cut criterion . . . "[1], then a good deal of doubt must at once be cast on the value or validity of cost comparisons between firms, or of the possibility of devising any single accounting system for an " industry " which will meet all the accounting needs of all the firms in it. In point of fact, if one looks at the groups of firms for which uniform costing systems have been devised in this country one finds that the common characteristic which binds each group together is not so much that all the firms in the group are producing substitutable products, but that they are using the same raw materials and subjecting them, broadly, to the same processes. However fatal product differentiation may be to the validity of the concept of an industry in the field of value theory, the concept is not without meaning for our present purpose. At the same time it must be recognised that that meaning is not at all precise. Technological differences between firms, like product differences, are matters of degree. Technologically, the differences between firm A and firm B, between B and C, C and D, may in each case be small, yet the difference between A and D may be great enough to make it difficult to recognise them as members of the same industry. Curiously, hardly any uniform costing schemes start by defining the range of firms to be comprehended by the system. Often a scheme deals with a process rather than an industry as commonly understood. In the case of iron and steel, for instance, there are in fact three schemes, not one. These deal separately with blast furnaces, open hearth steel furnaces and rolling mills. And specialised schemes have developed for other sections of the industry. In the plastics industry again, the three main sections—the moulders, the injection moulders and the fabricators—have distinct though similar systems.

THE BEGINNINGS OF UNIFORM COSTING

The uniform costing movement—it is not too much to call it a movement, for its exponents have often used the language of the crusade—is at least 60 years old, and seems to have made its first appearance in the United States in the iron stove trade. The National Association of Stove Manufacturers, which had been formed in 1872, had by 1889 developed a uniform " formula " for ascertaining the costs of individual articles. In 1891, the President, in his Presidential address, was able to say that " an excess of capacity now exists in about the same ratio as it did in 1872, but it is not as dangerous as then, because of the greater intercommunication of stove men and the consequent greater facilities for adjusting the production to the demand and because of the automatic regulation of a uniform cost system."[1]

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[1] R. Triffin, *Monopolistic Competition and General Equilibrium Theory*, I. quo., p. 188.

Among the printers in America, local typothetæ associations were at work on problems of cost finding before 1887 but it was not until 1910 that the Standard Uniform Cost Finding System for Printers was formally approved for general adoption by the United Typothetæ of America.[2] The activities of the printers in America are of particular interest for their bearing on the subsequent development of uniform costing in Great Britain, for the Master Printers in this country were taking a lively interest in what was going on in America. When the Federation of Master Printers set up a committee in 1911 to consider the question of " increased cost of production and the consequent necessity of increasing charges ", one of its duties was to visit America to study costing methods in use there. The main result of the committee's work was the appearance in April, 1913, of the Printers' Cost Finding System. This system, while not the earliest uniform costing system to appear in this country, is the oldest of those which are still actively being used.

It is, however, not among the printers but among the makers of iron bedsteads that the most notable English pioneer of uniform costing is to be found. This was E. J. Smith, the champion of the New Trades Combination Movement, who in a series of articles in the *Birmingham Daily Post* in 1895 and in his book[3] published in 1899 set out his scheme for ensuring that industrial competition should not result in losses to producers. This was to be achieved by ensuring, by agreement within each industry, that all producers should fix their prices by adding to their ascertained costs an agreed percentage for profit. "It is part of my scheme", he writes, "to establish in every trade a system of cost taking which, while it may not be all that could be desired when tested by the special circumstances of any individual business, is still all that is needed for the purpose of fixing throughout an entire trade a selling price for each manufactured article which will bring a legitimate and reasonable profit to each maker without unduly taxing the purchaser".[1] It is far from clear whether Smith wanted a uniform price to be charged by all producers as well as the adoption of uniform costing. In one passage, he says that the scheme does not involve uniform prices. "All that would be insisted on would be that, whatever the selling price, it bore the proportion of profit on dead cost agreed to."[2] But Mr. W. A. Addinsell, in a paper on "A new system of cost taking in trade" reprinted in Smith's book, and of which, presumably, Smith therefore approved, speaking of two producers making the same article by different processes, one cheap, one dear, says: "... any saving by the cheaper process which turns out as good an article as the dearer one is regarded as a question of management only, and the benefit must be retained by the maker instead of being given away in the selling price. Each member is at liberty to adopt whichever process he pleases, but the one he selects must be charged at the rate provided by the schedules."[3] It is interesting to find, at so early a stage in the development of uniform costing, justification of a later comment by a trade association secretary that "when you find uniform cost accounting systems, you find uniform figures".[4]

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[1] *The Iron Age*, 14th May, 1891, p. 933.

[2] For a detailed account of these develpoments see " Typothetæ Experiments with Price Maintenance and Cost Work ", by Leona M. Powell, in *Journal of Political Economy*, February, 1926, pp. 78–99.

[3] *The New Trades Combination Movement*, by E. J. Smith, 1899.

The relation of uniform costing to uniform prices has not always been one of cause and effect. In some cases the order of development was the other way round. The pottery industry provides an example. In April, 1901, a book was issued by the Earthenware Manufacturers' Association containing a number of schedules showing estimated costings of a large variety of goods for the guidance of manufacturers in fixing prices. It was not until 1921 that anything that could be called a uniform costing system for the industry was produced. And the Federation of Master Printers which, as has already been mentioned, published their Costing Scheme in 1913, had in 1907 published a booklet entitled '*Profit for Printers*' or '*What is Cost?*', which set out cost rates for hand and machine composition, said to be based on returns made to a London accountant by a number of printers. These figures were recommended for general adoption in the industry, for pricing purposes.

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[1] *Op. cit.*, p. 30.

[2] In a reprint of his *Birmingham Daily Post* articles, p. 12.

[3] Smith, *The New Trades Combination Movement*, p. 45.

[4] Federal Trade Commission, *Report on Open-Price Trade Associations*, 1929, p. 175.

The Extent of Uniform Costing in Great Britain

In Great Britain very little information is available about the activities of Trade Associations, and it is impossible to say how many Associations engage in costing activities or regard this as one of their functions. The possible range of such work is of course very wide. At one end of the scale, an Association may employ a permanent staff of cost accountants, publish an elaborate costing manual for the industry, install the recommended system for its members on request, deal with costing queries as they arise, regularly collect and tabulate cost statistics and circulate the information obtained among members. At the other end of the scale, an Association may do little more than undertake to establish contact between members seeking advice and some selected professional accountant with special knowledge of the industry. In Great Britain, at least, at the present time, though there are some notable exceptions, whose number is increasing, there is a tendency for Associations to approximate more to the latter extreme than to the former.

What is usually understood as uniform costing involves, as a minimum, the publication of a costing manual setting out a recommended costing system for adoption throughout the industry. In Great Britain about 26 such systems have appeared since 1913, from which year the earliest existing British scheme, that of the British Master Printers' Federation, dates. Seven schemes (pottery, paper box, paper bag, bakers, india-rubber manufacturers, tin box and electrical manufacturers) appeared between 1920–1930, and five (iron and steel, laundries, cocoa and confectionery, hosiery, and wholesale clothing) during the period 1931–39. Fourteen schemes (plastics, steel wire, cotton weaving, iron foundries, drop forgers, paint and varnish, black bolts, wholesale and manufacturing opticians, fertilisers, steel fabrication, dyeing and cleaning, brushes, gowns and millinery, and steel foundries) are the products of the war or post-war years.

If the progress of uniform costing could be measured by the rate at which new schemes have appeared it could fairly be described as being in a flourishing state. The true picture, however, is less impressive. The printing scheme certainly retains the interest of a substantial percentage of the firms in the industry. Of the seven schemes which appeared during the 1920's, however, not one now has anything more than a historical interest, and one industry (paper boxes) has recently started again with a new scheme. The systems prepared during the 1930's have fared better: those for iron and steel and laundries in particular have at least created an interest in costing among firms in the industry, and the iron and steel scheme has played a not unimportant part in determining the price structure in the industry. But although the hosiery scheme dates from 1936, the Hosiery Working Party found that until 1944–5 few manufacturers kept records of material usage and wastage, and it was rare for the wages charged in the unit costs to be reconciled with the total wages paid for a given period, overheads were seldom divided between factory overhead and general administration, and selling and distribution expenses were often lumped together under the general heading of overheads. The existence of uniform schemes in the pottery and clothing industries does not protect these industries from strictures on their standards of costing by their respective Working Parties. For the rest, it is perhaps too early to judge. Of the wartime and post-war schemes certainly none has yet proved itself. Of the potentially most important scheme among these, that for cotton weaving, issued as recently as 1947, a well-informed member of the industry said two years later that he knew of only one or two firms that had actually begun to use the scheme and that it had not received general acceptance by the industry.

The Position in the United States

In the United States, many more uniform costing schemes have made their appearance than in Great Britain but it seems doubtful whether they really play a more important part in industry. According to the Temporary National Economic

Committee's "Trade Association Survey",[1] out of a total of 1,244 Trade Associations in 1938–39, 560 engaged in accounting activities and worked on cost statistics and studies. Of these Associations, 269 included such work among their major activities. 348 Associations included the establishment of uniform accounting among their activities, 158 of them regarding this as one of their major activities. This and other evidence points to the effective existence of about 150 uniform costing schemes in the United States. Such a figure suggests that we are here confronting a major force in the organisation of American industry and many writers on this subject have given the same impression. Yet, apart from these figures, the available evidence does not unequivocally support such a view.

From a report on cost accounting in industry, published by the Accounting Department of the U.S. Office of Price Administration in 1946, it is possible to obtain some idea of the extent to which cost information is available in a wide range of industries which were subject to investigation by O.P.A. accountants during the period 1942–1945. The experience of the O.P.A. in this connection is summed up by Mr. Paul M. Green, at that time Deputy Administrator for Accounting in O.P.A., in the following words: "Our summary shows that there is a great variation in cost-accounting methods. It shows that cost records in some industries are far better than those in others, as would be expected. . . . It is difficult to judge exactly the percentage of all companies in all industries that can supply cost data on a product basis. The only completely accurate statement is that many of them cannot. Probably 85 per cent. of all industrial companies do not allocate cost on a product basis and 15 per cent. are readily able to produce such information."[2] Compare this with the view of the Federal Trade Commission in its Annual Report for 1916[3] that "10 per cent. of our manufacturers and merchants know the actual cost to manufacture and to sell their products. Forty per cent. estimate what these costs are, and 50 per cent. have no method". Even making full allowance for the fact that the O.P.A.'s figure of 15 per cent. relates to "all industrial companies," while the Federal Trade

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[1] T.N.E.C. *Monograph* No. 18, Washington, 1941. 76th Congress, 3rd session. Pp. 373–374.

[2] O.P.A. *Report on Cost Accounting in Industry*, p. iii.

[3] At p. 15.

Commission's 10 per cent. relates to "our manufacturers and merchants", the spread of cost knowledge in the 30 years which separates the two reports is not impressive. And when due credit is given to the educational efforts of the National Association of Cost Accountants, the increased use of mechanised accounting methods and other factors which have operated during the period in the direction of a more widespread use of cost accounting, the achievements of uniform costing in the United States would seem to have been rather modest. It is perhaps significant that in the O.P.A. report, uniform costing gets only one reference, in connection with the rubber industries.

Another light on uniform costing's uncertain hold on American industry is thrown by J. H. Foth, who in 1930 wrote about the experience of the American Photo-Engravers' Association, which had adopted a simple cost system as long ago as 1913: "The need for continuous cost education and the results of such efforts are well illustrated in the American Photo-Engravers' Association . . . after many years of educational work and perfecting of the system, the Association recently found it necessary to take vigorous steps to interest its members in cost accounting."[1] The experience of this Association in having to "interest its members in cost accounting" is typical of what has happened many times on both sides of the Atlantic, once the initial interest evoked by the appearance of a new uniform scheme has subsided.

THE WORKING PARTIES AND UNIFORM COSTING

Enough has been said to suggest that uniform costing has not been strikingly successful in winning support from industry. Yet at the present time there is no lack of advocates for its extension, and many advantages are claimed for it. Most of the claims commonly made are to be found in one or other of the reports of the Working Parties appointed by the President of the Board of Trade in 1945 and subsequently, as the following quotations will show:

(1) "Not until such a [uniform costing] system is in general operation will there be a reliable yardstick by which to

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[1] J. H. Foth, *Trade Associations*, p. 263. But it should also be noted that according to S. J. Lengyel ("Standardised Accountancy Considered Internationally," in *Accounting Research*, July, 1949, p. 135) "The Photo Engravers reported in 1938 that 323 of 511 member plants used the Association's uniform system".

measure efficiency or a basis for understanding between the individual manufacturers." (Domestic Glassware Report).

(2) " We regard the keeping of expenses and production records in a uniform manner as important in itself . . . If . . . all firms in the same section do the work in the same way, and use the same terms with the same meaning, there is a ready means available at any time for pooling information for the benefit of all, without any need for disclosure of business secrets to business rivals." (Cotton Report).

(3) " Whilst a standard [costing] system would not be easy to develop it would amply repay the time and trouble involved, and its development would increase the effectiveness of the costing itself. Once developed and commonly operating, it would allow a free and voluntary interchange between members of the industry of information that would incite valuable comparison. Instead of the best brains being confined to their own immediate field, they would receive stimulation from such comparisons and the contacts that would inevitably follow. . . . Efficient costing systems are not cheap to run and for this reason some manufacturers are tempted to use over-simplified systems. . . . If, however, the initiative were taken by the Council of the Heavy Clothing Industry to formulate a sound costing system the initial cost would be borne by the industry as a whole and the best system would thus be brought within the means of every member." (Heavy Clothing Report).

(4) " . . . there has been no effective attempt on the part of the industry to educate itself about costing or to introduce a uniform costing system so as to enable sufficient statistical information to be available to throw a clear light on the fortunes of the industry." (Jewellery and Silverware Report).

(5) " [A uniform system] would also enable comparison to be drawn between one manufacturer and another and provide more reliable information than is available at present for the purpose of the industry's price fixing arrangements." (Linoleum Report).

(6) " If the market is turning against the trade as a whole, joint action can be better planned and initiated, based on

known cost factors. When all are using the same system, the trade is insured against the damage that an individual manufacturer, through erroneous costing, can innocently engage in uneconomic trading and start a phase of weak selling." (Rubber Proofed Clothing Report).

It will be noted that the arguments for uniform costing which are advanced above are of two distinct kinds. The first set of arguments suggests that uniform costing will raise industrial efficiency, the second that it will limit price competition. Unfortunately, this latter tendency is likely to counteract any beneficial effect on efficiency which uniform costing might otherwise have. There is also running through the reports a tendency to confuse demands for *more* costing with a call for *more uniform* costing. These two objectives are, of course, distinct—they may even be contradictory, in the sense that a more widespread use of costing may lead to more, not less, diversification. But what most of the Working Parties want is both more costing and more uniformity.

Before proceeding to examine the arguments for and against uniform costing, some more adequate description of it needs to be given than is contained in the bare definition with which this article began. To such a description we shall now turn.

Contents of a Representative Uniform Cost System

Some uniform cost systems, especially some of the earlier ones, have been sketchy in the extreme, and have fallen far short of the minimum degree of precision in instructions to users which is essential if any uniformity of practice is to be secured. Other schemes have been worked out with great care, so as to provide for almost every possible contingency. There is, therefore, really no *typical* system. But it is possible to specify a number of matters which will usually be dealt with in any scheme which purports both to be practical and to provide an effective degree of uniformity.

1. It is necessary to define for each industry what it is that is being costed, i.e., the product or process unit or units the cost of which is being ascertained by the cost system. Other general characteristics of the system also need to be clearly described. To what extent, if at all, are the total

costs shown in each firm's cost statements to be "tied in" with the total expenditure recorded in the firm's financial accounting system? Does the system provide for a comparison of actual costs with standard costs computed on the basis of what management regards as a desirable and attainable level of efficiency and productive activity? An examination of the existing British systems shows that, in general, they do not provide for such comparisons of actual and standard costs: they do place considerable emphasis on the value of relating the cost figures closely to the figures in the financial books.

2. Definitions of all elements of cost must be given. The content of prime cost—direct materials, direct labour, direct expense—and of each subdivision of overhead expenses, i.e., works, selling and administrative overhead, must be defined precisely, so as to eliminate any possibility that different firms might record and subsequently report the same costs under different heads. At the same time, certain expenditure will usually be specifically excluded from costs, e.g., taxation, debenture interest, etc., and these exclusions need clearly to be set out.

It is becoming common for all modern schemes to include a code of accounts. All assets, liabilities, expenditures and incomes are listed and numbered, and the content of each account is specified. The accounts for expenditure and income are arranged in groups so that the content of such group totals as prime cost or works overheads is automatically also specified. Quite apart from the gain in clarity and precision which this system brings, the numerical code greatly facilitates the adoption of mechanical methods of accounting.

Uniformity of definition within an industry is of the essence of uniform costing. A comparison of the definitions used by different industries shows, on the other hand, a remarkable lack of uniformity, in spite of the efforts of the Institute of Cost and Works Accountants to secure a standardised costing terminology. Almost any costing term could be taken as an example, but "direct materials" will serve. The definitions of this term to be found in the British uniform systems fall into two groups. One group, which includes the definitions used by the printers, iron founders, and steel fabricators, consists of variations on the theme that direct materials are those which can be charged direct to the job, or customer, or specific cost unit. The other group of definitions, which includes those of the steel wire makers and drop forgers, takes as the test of "directness" in materials that they should actually enter into the body of the finished product. There are, too, many variations on this formula. The different ways in which different industries define "direct materials" are partly explainable by reference to each industry's specific problems. Thus, for chocolate or hosiery manufacture, boxes are important enough to be included in direct materials, whereas in some other industries packing is a distribution overhead. But if differences of definition as between industries are to be explained by reference to their different needs, it seems perhaps possible that, in view of the difficulty of defining an "industry", different firms in the same "industry" may also find their interests better served by some diversity of definition rather than by uniformity. Any justification for diversity of definitions between industries may to a considerable extent also justify diversity between firms in the same industry.

3. Wherever the value of resources is liable to change between the date of their purchase and their consumption in a productive process, the basis on which they are to be valued for inclusion in the costs needs to be defined. More specifically, the basis of valuation of raw material issues and the basis for computing depreciation of fixed assets ought to be laid down.

What is deemed important for uniform costing is that all firms in the industry should adopt the same valuation bases. Yet, surprisingly, an examination of the existing British schemes shows that remarkably few of them contain any precise directions on either of these important sources of disuniformity. And those which do by no means agree on the manner in which these problems are to be dealt with, as the following tabulation of a random selection of schemes shows:

Scheme	*Basis of Valuing Material Issues*	*Basis of Calculating Depreciation of Plant*
Printers	Not specified	By diminishing balance method on "working value" of plant (which is not necessarily book value)
Iron and Steel ..	At current values	Depreciation not included in costs
Plastics	First-in-first-out	Not specified

Scheme	*Basis of Valuing Material Issues*	*Basis of Calculating Depreciation of Plant*
Cotton Weaving	At standard price	By straight-line method, on "replacement value" of plant
Steel Wire	At Trade Association's list price	At Income Tax wear and tear rates on diminishing balance
Laundries	Not specified	At 15 per cent. on written down value
Cocoa and Confectionery	Actual cost, if ascertainable, or average cost	At 7½ per cent.—15 per cent. according to life of plant
Steel Foundries	Average cost	At 120 per cent. of Income Tax wear and tear rates

It is, of course, not a mere difference in depreciation *rates* which is here in question. That would be sufficiently explained by the different conditions in different industries. But these differences are not sufficient to explain the extraordinary variety of *methods* which have just been listed.

4. Since uniform costing schemes, as at present conceived, always aim at computing average total cost, the method of apportioning overheads has to be specified. This involves answering many questions. What productive departments are to be distinguished within the firm ? Are departments to be further divided into cost centres ?[1] What service functions are to be treated as separate departments ? Are overheads to be subdivided into such categories as works, selling and administration overheads, and in what way ? And how is each kind of overhead expense to be apportioned to departments and ultimately to units of product ?

As might be expected, a great variety of methods for dealing with these questions is to be found among the existing uniform systems. Here, too, many of the differences between methods in different industries are naturally due to real differences between the industries. But some at least of the variations are no more than reflections of the essentially arbitrary nature of any method of allocating " common costs ".

5. A fundamental aspect of the problem of allocating overheads concerns the treatment of idle capacity. Are full overheads to be charged to current output even when this represents substantially less than full capacity ? Or is a separate " cost of idle capacity " to be ascertained and

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[1] Defined as a production unit, within a department, for which separate running costs can be ascertained.

written off as unproductive expenditure? The following tabulation shows how this problem is dealt with by 16 British uniform schemes:

Scheme	*Treatment of Idle Capacity Costs*
Iron and Steel, and Black Bolts	Temporarily idle plant is to be charged with due proportion of charges which continue to be incurred and which would have been charged to production if plant had been working. Permanently idle plant is to be charged only with amounts directly incurred on it. Both sets of charges to be written off as unproductive losses
Plastics	Labour "idle time" to be charged as indirect labour
Cotton Weaving	Fixed and variable costs are distinguished, so that effect on costs of changes in capacity usage can be seen
Iron Foundries	Standard overhead rate is recommended, so that effect of idle capacity will be reflected in under-absorption of overheads
Brushes	Full overheads charged to current output, even when this is below normal
Fertilisers	Proportion of overheads pertaining to idle plant to be written off as unproductive loss only in exceptional circumstances, e.g., where plant is surplus to requirements. Otherwise, costs of idle capacity, if above normal, to be noted for information, but to be left in cost records as current running costs (Idleness above normal means idleness due to seasonal shut down, major repairs, planned shut down of excess capacity, etc.)
Dyeing and Cleaning	Value of information as to costs of idle capacity is mentioned, but the system does not give the information
Printers, Steel Wire, Steel Fabricating, Laundries, Cocoa and Confectionery, Drop Forging, Hosiery, Opticians	Not specified

6. Besides the materials and services which have to be paid for by current disbursements, there may be other factors of production employed in the business which, because they are owned by the proprietors, give their services "free". Freehold buildings are occupied rent-free. The proprietors' capital involves no outlay of interest. A sole trader's business or a partnership will be managed by the proprietor(s), whose remuneration will emerge as profit rather than as a cost. Even in a private limited company, the directors' salaries, which are fixed at will, may bear no relation to the market value of the managerial services which the directors render. In any cost comparison between a firm which hires all its factors and one which owns some, costs have to be "imputed" to the owned factors in order that the recorded costs of the two firms may be truly comparable.

Here again, there is a valuation problem. How are the proprietors' managerial services (if any) to be valued?

How is the occupancy of freehold buildings to be assessed? And in the case of interest on capital, there is, besides, the whole vexed question (at least it vexes cost accountants if not economists) of whether this should be included in costs at all, even when the capital is borrowed and interest on it has actually to be disbursed.

It will, by now, not be surprising to find a great variety of approaches to these questions in the British Uniform Systems which have been examined. The following tabulation will give some idea of the variety of methods recommended :

	Treatment of Interest on Capital	*Proprietor's Services*	*Owned Buildings*
Printers	Charge interest at 5 per cent. on all capital employed	Allow a "reasonable" salary	Charge interest on the capital value of buildings, a "fair" amount for depreciation, and all maintenance costs
Iron and Steel, Cotton Weaving, Iron Foundries, Black Bolts	Interest not to be included in costs	Not dealt with	Not dealt with
Steel Wire	Interest is regarded as an appropriation of profit, not as a cost	"Reasonable" remuneration to be charged	Not dealt with
Laundries	Interest is not regarded as a cost, but is to be entered on cost sheets as a memorandum entry	A "proper" allowance to be made for proprietor's services	Charge annual rateable value in lieu of rent
Cocoa, Chocolate and Confectionery	Not dealt with (but see last column)	Charge a "reasonable" salary for managerial services and usual rates for other services	Mortgage interest, if any, to be treated as rent of mortgaged building
Hosiery	Interest to be omitted from costs but to be considered when fixing price, as part of the profit	Not dealt with	Charge gross Schedule A Assessment
Brushes	Interest to be omitted from costs	Charge a "reasonable" salary—what an employee would have to be paid	Charge depreciation at 2 per cent. p.a. on original cost, or net Schedule A Assessment
Clothing	Inclusion of interest in costs is regarded as theoretically correct, but it is to be excluded to avoid "controversy and confusion"	Partner's actual salary to be charged	Not dealt with

	Treatment of Interest on Capital	*Proprietor's Services*	*Owned Buildings*
Opticians	Only interest on short-term bank overdraft to be included in overheads. Long-term interest to be treated as appropriation of profits	To be treated like directors' remuneration	Charge gross Schedule A assessment
Fertilisers	Interest not to be included in costs	Charge a notional amount "appropriate to the services rendered"	Nothing is to be included in costs for occupancy of owned buildings
Steel Fabricating	In general, interest should be excluded from costs but it should be included where: (1) work on job goes on over extended period without commensurate progress payments (2) money is borrowed to finance a specific contract (3) materials require maturing — interest then to be included in the materials charge	Not dealt with	Charge expenditure, on repairs and maintenance, and depreciation of buildings in lieu of rent
Dyeing and Cleaning, Plastics, Drop Forging	Not dealt with	Not dealt with	Not dealt with

It would be tempting to look for profound explanations of the striking lack of uniformity in the treatment advocated by different industries of the specific costing problems which have just been examined. Yet such evidence as there is suggests that no such profound reasons exist. The methods incorporated in an industry's costing scheme tend to be those already widely adopted in the industry, or it may happen that a particularly forceful member of the costing committee charged with the preparation of the scheme is able to press his views on his more pliable colleagues and get them written into the scheme. One of the oddities of British uniform costing—the complete exclusion of depreciation from costs in the iron and steel industry—has no more profound explanation than that the costing committee which drew up the original scheme left depreciation for special subsequent consideration but has never in fact filled this gap in the scheme.[1]

7. If the system is to appeal to all or most of the firms in an industry, it must endeavour to meet the differing needs of large and small firms. It is, perhaps, to a failure to do this that the demise of a number of schemes can be attributed. In the main, two methods have been used to permit diversity in costing schemes without abandoning their essential uniformity. Sometimes two or three versions of the scheme have been prepared, all basically similar but introducing into the versions adopted for larger firms more detail and complexity than is permitted in the small-firm versions. In other cases, only one scheme is prepared, but within the broad outlines applicable to all firms, additional detail is introduced by the subdivision of main account heads for adoption only by the larger firms.

(*To be concluded*)

The London School of Economics.

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[1] "DEPRECIATION AND OBSOLESCENCE. It is recognised that provision for depreciation and obsolescence is a proper charge against cost, and that the basis for the determination of the provision for inclusion in the cost requires thorough investigation.

Pending such investigation it is recommended that costs shall not include any provision for depreciation and obsolescence, but that for statistical purposes the provision might be entered as a footnote."—*The Iron and Steel Industry Uniform Cost System*, p. 14.

Notes on Resale Price Maintenance

By B. S. Yamey

The Report of the (Lloyd Jacob) Committee on Resale Price Maintenance[1] re-opens the question whether the public interest is promoted or injured by the practice of resale price maintenance. Unlike its predecessors[2] the present Report is emphatic about at least one aspect of the trade practice: evidence is summarised to demonstrate with clarity that price maintenance destroys or distorts competition in the distributive trades[3]; and that if this effect is considered alone, the practice is against the public interest.

This important aspect of the Report is not considered in the present note which is confined to the following topics: (*a*) an examination of the scope of the Committee's recommendations[4]; (*b*) an examination of the likely effects of a complete prohibition of resale price maintenance practices; and (*c*) an appraisal of the Committee's views on "loss-leader" price-cutting in the distributive trades.

I

It may be useful to distinguish three types of resale price maintenance arrangements. (*a*) On his own initiative and in order to promote the sales of his products a manufacturer may sell his products subject to resale price maintenance conditions. He introduces the agreements, administers the scheme, and enforces compliance with its terms; (*b*) A manufacturer may introduce a system of price maintenance agreements under pressure from an organised group of distributors (wholesalers and/or retailers), which is sufficiently strong to use the threat of a boycott of the products of unwilling manufacturers. Apart from the nature of the origins of such schemes, there may be nothing in their operation to differentiate them from schemes of type (*a*) above; (*c*) Associations of manufacturers may conduct resale price maintenance schemes in co-operation with associations of distributors. Resale price maintenance is collectively administered and enforced.

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[1] Cmd. 7696, 1949.

[2] Report by a sub-committee of the Standing Committee on Trusts, Cmd. 662, 1920; Report of the Committee on Restraint of Trade, 1931.

[3] On this point see also Report of the Committee on Milk Distribution, Cmd. 7414, 1948, paras. 162 *et seq.*, and the Simon Committee's Report on the Distribution of Building Materials and Components (1948), para. 73.

[4] In the main the Government has accepted the recommendations. See the statement by the President of the Board of Trade, *Parliamentary Debates*, *House of Commons*, 2nd June, 1949, col. 2329.

The Committee's recommendations are unambiguous with respect to collective schemes [type (*c*)]. Such schemes are held to be undesirable. They " have led to the comprehensive regulation of competition in the distributive trades " and " have impeded the development of economical methods of trading and prevented the reduction of distributive costs and prices " (para. 166).

As regards individually administered schemes [type (a)] the Committee recommends " that no action should be taken which would deprive an individual producer of the power to prescribe and enforce resale prices for goods bearing his brand " (para. 163). However, the Committee's next recommendation, if it means anything at all, does deprive the individual producer of his power to operate price maintenance by introducing a number of conditions subject to which price maintenance may be used. It stipulates that in exercising their power " producers are not . . . entitled to use resale price maintenance to obstruct the development of particular methods of trading, to impede the distribution by another manufacturer of competitive goods or to deprive the public of the benefits of improvements in distribution. Public policy requires adequate distribution of goods with provision for such price reductions as are justified by low-cost distribution " (para. 164). In other words, the individual producer may use the device of price maintenance, but only if allowance is made for so many exceptions to the rule of a fixed and uniform resale price that the practice is likely to be meaningless, ineffectual and unenforceable. The Committee approves of price maintenance, but only if elaborate precautions are taken to ensure that the inevitable consequences of price maintenance do not take place. If this part of the Committee's recommendations is enforced literally and effectively it is safe to predict that before long the practice of price maintenance would have disappeared altogether. It is more likely that the recommendation will be " interpreted " in the course of the " consultations with the principal national organisations in trade and industry " that appropriate government departments are recommended to hold to consider the most satisfactory means of ensuring that the recommended policy is made effective (para. 165). No forecast of the future of resale price maintenance is possible until the " interpretation " is provided.

The Committee's recommendations do not deal specifically with price maintenance schemes introduced in response to pressure from organised distributors. Such schemes will naturally be subject to the " conditions " discussed in the preceding paragraph. Also they will be considered undesirable if organised distributors participate in the administration or enforcement of the agreements. But there is no specific indication of the Committee's attitude towards the mere presence of organisations using the threat of the boycott to bring individual producers into line with their own ideas of " fair trading ". The tenor of the Committee's recommendations is critical of the existence and activities of pressure groups. A special recommendation to deal with the situation would have been useful; for if collective price maintenance schemes are broken up or rendered impotent it is not unlikely that in some trades organised distributors, anxious to preserve the benefits of price maintenance, may attempt to persuade individual manufacturers to continue price maintenance in a new and (ostensibly) permitted guise. Experience in the United States of America suggests that majority groups of distributors may wield considerable powers of persuasion.[1]

Save for the conditions that the Committee attaches to its approval of individually-administered schemes, the Committee's recommendations, if put into effect, would bring the law's attitude towards resale price maintenance in Britain much closer to the law's present attitude in the

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[1] " Distributors' organizations have used boycotts, preferential salesmanship, and various forms of intimidation and persuasion to induce reluctant manufacturers to issue resale-price contracts and to persuade them to make resale prices and margins satisfactory from the distributor's point of view." (Corwin D. Edwards, *Maintaining Competition*, New York (1949), pp. 71–2). See also E. T. Grether, *Price Control under Fair Trade Legislation*, New York (1939), pp. 90 *et seq.*

United States.[1] It is interesting to note that the position in Britain would have been reached as a conscious departure from an earlier policy of non-interference by the law in the field of trade practices, whilst the substantially similar position has been reached in the United States (in the 1930's) as a conscious and very reluctant (and possibly temporary) departure from a policy of hostility towards restrictive trade practices.

II

Much of the Report sets out the reasons that prompted the Committee to give its (qualified) approval to individually administered price maintenance schemes, despite its finding that price maintenance in general raises the cost of distribution and impairs the flexibility and adaptability of the distributive trades. The Committee begins its recommendations by stating that its investigations have led it on to the horns of a dilemma. " Our inquiry has revealed a conflict between two apparently contradictory aims—the need on the one hand to encourage the development of more economical methods of distribution and the reduction of retail prices and on the other hand to maintain the quality, continuity of production and ready supply to the public of established British brands " (para. 159). Seemingly the Committee has been unable to resolve the conflict. It has been unable to state which of two apparently conflicting ends of economic policy should be placed first: greater efficiency in distribution, or greater efficiency in production.[2] Its compromise recommendations seem to seek the best of both worlds and in consequence, as has been noted before, they are contradictory and require interpretation and clarification.

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[1] Two of the remaining differences would be the following:

(i) In the U.S.A. price maintenance is permissible only where the brand is in free competition with other similar goods. The recommendations of the Lloyd Jacob Committee do not restrict the privilege in this manner.

(ii) In several States in the U.S.A. the right to enter into price maintenance agreements is not explicitly limited to the owner of the brand or his authorised distributor. In these states the resale price maintenance contract has been used in attempts by co-operating groups of distributors to fix prices to be maintained for branded goods without the consent, and sometimes against the will, of the brand-owners. The recommendations of the Lloyd Jacob Committee limit the exercise of the power to fix resale prices to the brand-owners.

For developments in the U.S.A., see Grether, *op. cit.*; Federal Trade Commission, *Report on Resale Price Maintenance*, Washington (1945); Edwards, *op. cit.*, pp. 66–73; J. R. Van de Water, " Florida's Fair Trade Fight ", *Journal of Marketing*, Vol. XIV, No. 4 (January, 1950).

[2] Mr. Henry Smith, a member of the Committee, takes issue with the Committee on this point, and also on other points. See his note in the Report, pp. 34–5.

It is not easy to discover satisfactorily from the Report how the Committee arrived at its finding that in some circumstances resale price maintenance may help "to maintain the quality, continuity of production and ready supply" of established brands of merchandise. For it is possible to demolish, or at least to weaken, a good deal of the argument presented in the Report. It is therefore a pity that the evidence of manufacturers, which obviously impressed the Committee, is not reproduced for the benefit of readers of the Report.

Resale price maintenance[1] is a device for promoting the sales of the products or brands of the manufacturer practising it. It promotes the sales, in appropriate conditions,[2] of the "protected" brands by securing the sales co-operation of a number of distributors, who, being satisfied with the guaranteed profit margins, are prepared to push the sales of the brands in preference to competing brands not similarly "protected". Like every other sales promotion device it is likely to be copied by competitors if it is successful. And like every other sales promotion device, if it is successful in increasing or stabilising sales, it contributes towards the "stability and continuity" of the production of the brand concerned. In some cases this may lead to a reduction in the unit costs of production of the brand.

What the Committee should have demonstrated is that the complete banning or prohibition[3] of the particular sales promotion practice (resale price maintenance) would play havoc with the stability and continuity of production of branded goods, in the long run as well as in the transitional period. It is suggested that it is not possible to demonstrate this in respect of most classes of goods. There is no evidence to suggest that the production of branded goods has been more "stable and continuous" in Britain than in other countries, such as the United States, where price maintenance has not been practised on so large a scale as in Britain. Price competition in retailing has not led to the " undesirable " excess of instability in retailing[1] that the Report implies and fears.[2] There is nothing to suggest that manufacturers, unable or unwilling to practise price maintenance, have not been able for that reason to keep up the quality of their brands at all times. Indeed, the Committee's acceptance of the " argument advanced by some manufacturers that the uncertainty brought about by prolonged price-cutting may make it difficult and sometimes impossible for them to maintain the quality . . . of their branded goods " (para. 84) is startling. It has always been argued by manufacturers that the practice of branding safeguards the consumer against variations in quality. Is the safeguard to be conditional upon the elimination or the moderation of price competition in retailing ?[3]

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[1] Here, individually administered schemes.

[2] Professor Plant has suggested that in some cases manufacturers may have adopted resale price maintenance in inappropriate circumstances. See his discussion, "The Distribution of Proprietary Articles", in *Some Modern Business Problems*, London (1937), pp. 301 *et. seq.* For an account of an unsuccessful adoption of the practice, see W. C. Behoteguy, "Resale Price Maintenance in the Tyre Industry", in *Journal of Marketing*, Vol. XIII, No. 3 (January, 1949).

[3] Assuming this to be possible. The Simon Committee (*op. cit.*, p. 52) suggested that in the field of building materials it might be desirable, after enquiry, "to declare individual agreements or types of agreement between manufacturer and merchant to be in restraint of trade and illegal".

One cannot suppress the suspicion that the Committee has concerned itself unduly with an irrelevant case, that of the manufacturer who is deprived of the right to maintain his resale prices, while (implicitly) his competitors are not so deprived. (See, for example, para. 42). In these circumstances the manufacturer *may* suffer losses, and the continuity of his production *may* be disturbed. (This is the case of the manufacturer who is unable to enforce price maintenance against price-cutters while his competitors are more successful in this activity.) It is fallacious to regard this case as an argument in favour of price maintenance. The appropriate case to consider is where all competing firms are deprived of the use of the selling device, and all competing brands are exposed to the " risks " of price-cutting in the retail markets. While the relative positions of different firms and brands may be altered, it is by no means certain that the established brands (for which some consumer preference has developed) or the high-quality brands, for which the Committee shows some concern, are likely to suffer most, if at all. In some trades it is the well-established firms that resist attempts at price maintenance most strenuously, and welcome the sales-promoting effects of lower retail prices.[1]

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[1] " Undesirable ", that is, from the manufacturers' and consumers' points of view.

[2] Manufacturers in the United States on the whole showed little enthusiasm for resale price maintenance (when it was made a legitimate trade practice) except where the strength of organised distributors could not be ignored. It is worth noting that the pressure for the passage of legislation permitting price maintenance in the United States came almost entirely from organisations of distributors.

[3] Owners of trade marks, etc., receive considerable protection in terms of the special legislation dealing with such property. The Committee's argument is that in the general interest brand-owners should be entitled to additional protection.

The effective prohibition of all resale price maintenance schemes is likely to be uneven in its effects on different firms producing brands of the same type of products. The prohibition of any existing trade practice or method of sales promotion is likely to cause individual hardship and to upset established profit expectations in some cases. The impact effects may be considerable; but this is no argument against the prohibition if it is desirable on general grounds.

It will be appreciated from the above that price maintenance of the kind described is a concomitant, in appropriate circumstances, of the practice of branding. On this wider issue the Committee "assumed that, although there may be incidental disadvantages or abuses, the system by which manufacturers purposely differentiate their products from those of other manufacturers and actively promote their sale by advertisement and by other means, is not, generally speaking, in conflict with the public interest" (para. 23). In making this assumption the Committee in effect should have disposed of the problem; for the individually administered price maintenance scheme is, basically, merely one of the "other means" of sales promotion used by some manufacturers of branded goods. Its confusing recommendations indicate that the Committee was not prepared to abide by its "assumption".

III

Though the propositions of welfare economics do not provide a scientific guide in the matter, the economist is not likely to demur at a policy of banning resale price maintenance if it achieves economies in distribution[2] and merely causes some redistribution of demand among rival brands of the same class of product (and probably increases the demand for the class of product in the aggregate, by permitting reductions in prices by retailers). Judgment may be more difficult in a minority of cases where the banning of resale price maintenance (individually or collectively administered) may reduce the demand for certain classes of product in the aggregate (i.e., taking all brands together).

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[1] For example, see Federal Trade Commission: *Report on Resale Price Maintenance*, p. xxxvii.

[2] On the other hand the compulsory discontinuance of resale price maintenance is likely to lead (to an extent which is difficult to predict) to the increased use of alternative permitted methods of sales promotion. For example, competing manufacturers may make more extensive use of press and other advertising; a greater number of manufacturers than at present may consider it necessary to take over the wholesale (and possibly retail) distribution of their brands; and more manufacturers may be tempted to adopt systems of exclusive dealerships. The alternatives are not necessarily likely to be less harmful to economy in distribution than price maintenance itself.

The exceptional classes of products are those that are often bought on impulse by consumers, so that total sales may be boosted if the number and dispersion of retail outlets stocking the products are increased; and those that demand, for their effective selling, considerable retail display and the provision of advice and information by retailers to consumers. Chocolates and cigarettes, books, and some electrical appliances may be cited as (possible) examples of these special classes of products. It may be argued that effective price maintenance, by encouraging retailers to stock the lines, may secure the widespread distribution needed to stimulate sales; and that guaranteed and attractive profit margins encourage retailers to display and demonstrate the merchandise effectively.

For these classes of products no other method of sales promotion may be nearly so effective as resale price maintenance; so that the prohibition of the practice would lead to long-run as well as transitional declines in demand.[1] However, even in regard to the special classes of products under discussion, the exceptional efficacy of price maintenance should not be overstated. For example, without price maintenance there is no reason why manufacturers should not support retailers who stock, display, and sell their products effectively, by granting special discounts to them for their special services, in this way enabling these retailers to compete successfully with mere order-taking retailers who do not have to meet the costs of display, etc.

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[1] The existence of such classes of products may explain why it may be profitable for a sole supplier (or dominant supplier) of a product to employ resale price maintenance. He may use it not to secure the co-operation of distributors against his competitors (i.e., manufacturers producing competing *brands*), who are assumed to be negligible, but to secure a large number of selling and display points, without which sales volume may suffer. The monopolist may consider it necessary to "protect" his distributors in order to secure their co-operation (or to remove their apathy) in the competition of his product against all other products available to the consumer.

In the majority of cases a monopolist manufacturer would not find it profitable to introduce price maintenance, except possibly as an added safeguard against the entry and establishment of competitors.

Again, price competition in the retail market need not lead to any serious loss of "impulse" sales; for "impulse buyers" would ordinarily not be deterred by the fact that prices differed somewhat from outlet to outlet.

Nevertheless, special cases may be recognised, though their importance should not be exaggerated. The prohibition of resale price maintenance (particularly of collectively administered price maintenance schemes) *may* bring about a redistribution of demand, prejudicing some few classes of products. Whether the resulting change in the pattern of demand is a small or a large price to pay for increased efficiency in the distributive trades, is a question that the economist, as economist, is not in a position to answer.

The Committee does not give specific consideration to the exceptional classes of products in its Report; and its recommendations do not seem to give any special attention to their existence. Perhaps this "omission" reflects a sensible weighing-up of the relative unimportance of the special classes. The occasional references to the problem of the special services required by manufacturers of retailers in the sale of some products are not helpful (paras. 36, 45 and 84); they display a paternal desire to "protect" the consumer by denying him the real choice between the low-cost distributor providing little service and the higher-cost distributor, who, in the words of the Report, "provides a service whose value may not be recognised until it has disappeared" (para. 84).

IV

In its condemnation of selective price-cutting in retailing, because of its demoralising and upsetting effects in the retail market, the Committee attempts to distinguish between socially desirable and socially undesirable forms of price-cutting. Price-cutting is desirable if it reflects the ability of the retailer to reduce his operating expenses, or if it takes advantage of some hitherto unsuspected elasticity in the demand for a product. It is undesirable if it is used as an "aggressive weapon of competition". A retailer who cuts the price of a few lines in order to attract custom to his establishment is considered to bring the shopping public no substantial or lasting benefits, while at the same time he unsettles the market of the brands selected as temporary bait to consumers, and contributes towards instability in retailing and in manufacturing. The practice is considered particularly undesirable if the retailer uses different brands or lines in succession as bait, and the public is supposed to suffer most if the price-cutter sells his merchandise bait at less than its cost to him.

The " loss-leader " seller is dramatised as the villain in the piece. It is he and his kind whose hit-and-run methods of price-cutting are so disastrous that individually administered price maintenance is to be tolerated as being the most effective weapon available to check loss-leader price-cutting in the interests of stable and continuous production of established brands. " Resale price maintenance offers a convenient means of protecting brands against misuse by distributors in this [i.e., loss-leader selling] or other ways " (para. 162). And Mr. Henry Smith indicates that it is only because he does not think " that legislation designed to limit the use of loss-leaders would be easy to frame, or practicable to operate " that he was prepared to support the recommendations of his colleagues on the Lloyd Jacob Committee that resale price maintenance should be allowed to continue in a restricted form.[1]

Perhaps retailing in Britian has been spared the horrors of loss-leader price-cutting for so long that they are now but dimly remembered, and present themselves in a fearful light. Perhaps, too, long experience with price maintenance has meant that the occasional price-cutters in price-maintained trades have often been of doubtful respectability or even of doubtful morals. It is possible, too, that the sales promotion device of loss-leader selling may often go hand in hand with deceptive dealing; though this is not an inevitable accompaniment of the practice, nor one that is confined to loss-leader tactics alone. All this may excuse the Committee if it may appear to some of the readers of its Report that it has been guilty of exaggeration. More important, it is doubtful whether loss-leader selling, even if the Committee has not exaggerated its likely extent, is entitled to so crucial a role in the history of price maintenance as it is given in the Report.

The " average retailer " whose attitude is important to the manufacturer seeking a wide market for his brands tends to dislike all forms of price competition. It is for this reason that in some circumstances a manufacturer may decide to oblige the majority of retailers by instituting price maintenance and so preventing all forms of price competition in the retailing of his brands. But the " average retailer ", it is suggested, is more likely to resent the prolonged and generalised price reductions of efficient competitors than the sporadic and selective reductions of loss-leader selling. He can in most cases take appropriate, though unpleasant, action to neutralise the effects of loss-leader competition, which in any case is likely to be temporary, and not so general in its appeal to consumers as the all-round price reductions of efficient competitors. Competition resulting from lower costs is a real and lasting threat to the profits and the security of the " average retailer ". Consequently, though he may wish for protection against all forms of disturbing competition, he is more likely to demand protection against low-cost competition, and to retaliate, as best he can, against manufacturers who refuse to grant it.

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[1] See Mr. Smith's Note in the Report, p. 35. His support of the Committee's recommendations is not enthusiastic.

The Committee, of course, does not wish to stifle socially desirable competition; hence its *conditional* approval of individually administered price maintenance schemes. But if it could have accepted the view that loss-leader selling is not the crucial issue, it would have been possible for it to have arrived at conclusions wholly antipathetic towards price maintenance. Its dilemma would have been resolved; for no manufacturer is likely to introduce price maintenance *solely* in order to stop loss-leader selling of his brands, if, in line with the Committee's recommendations (literally construed), low-cost distributors are to be permitted to sell them below their " maintained " prices.

The above conclusion may seem to suggest that the manufacturer of a brand selected as a loss-leader may suffer losses *only* because of the unfavourable reactions of the " average retailers " who dislike price competition. However, it is conceivable that he *may* sometimes suffer losses even if the rest of the retail trade does nothing about the price-cutting.[1] Here, from the manufacturer's point of view, is a real difference between loss-leader price-cutting and other forms of price-cutting. The conclusion in the preceding paragraph merely implies that considerations, other than of the probable reactions of the rest of the retail trade, are not likely to be sufficiently important to the manufacturer to induce him to take costly steps to prevent loss-leader selling.

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[1] For example, the price-cutting retailer, in order to keep down his direct losses, may try to minimise his sales of the loss-leader brand. He may try to switch demand to normally priced substitute brands; he may deliberately run out of stock; and he may discontinue stocking the brand once it has served its purpose. Here the manufacturer's sales of his brand may be reduced, even if the rest of the retail trade remained passive. But the possibility of switching demand, etc., is small where the brand selected as loss-leader is well-known—loss-leader selling is not very successful unless the brand is well-known. And loss-leader selling is not necessarily associated with the practices of " switching ", etc.

Resale price maintenance is a blunt weapon with which to attack loss-leader selling. The likely presence of organised groups of distributors may too easily cause the weapon to be used to serve other purposes of which the Committee would not approve. If it is considered desirable to restrain loss-leader selling in retailing, direct legislation to deal with the supposed evil is preferable. It is not certain that legislation designed to limit the use of loss-leader tactics would be any more difficult to frame and to apply than it would be to apply the Committee's recommendations strictly.[1]

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[1] If the aim is to eliminate loss-leaders at the discretion of the brand-owner, this aim may be achieved by legislation making it an offence for any distributor to sell branded goods (in respect of which the brand-owner has given notice that he wants the protection to operate) below the current replacement price to that distributor. It may be noted that the interpretation of the term "loss-leader" adopted in this footnote is more definite than the one adopted by the Committee (Report, p. 9n). The vagueness of the Committee's "definition" indicates the difficulties surrounding *any* measure aimed at that practice.

Notes on the Maximisation Process in Company Administration

By G. F. Thirlby

1. In opening a review of Professors Copeland and Towl's *The Board of Directors and Business Management*,[1] Professor P. Sargant Florence remarked that " it is one of the oddities of economic literature that almost nothing, in England at least, has been written at University level on the modern joint-stock company, and still less on its directors ".[2] To students of business administration, it may seem equally odd that, so far, little has been done to integrate into the body of pure economics any developed theory of the functioning of the administrative organisation. It is generally assumed that the entrepreneur, or the firm, decides to maximise profit, or net revenue, and takes action accordingly ; but little is said about the interrelations of the planning and executory activities of people within the unit pursuing the maximisation, when this unit consists of more than one person, or, more precisely, when it consists of an organisation of human beings whose activities are consciously oriented towards a common goal. The joint-stock company, with the board of directors within it, may be regarded as a special case of such an organisation.

The following notes are the result of an attempt to place the function of the board of directors in an appropriate theoretical perspective. It is not pretended that they present a complete theory of the functioning of the organisation.

2. The situation with which we are dealing is one which allows a considerable measure of divorce of control from risk-bearing. Incorporation, which permits diffused shareholding and limited liability, and so facilitates the attraction

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[1] Harvard University Press, 1947. Informative and valuable as this work is, it leaves the impression that the authors' commentary on the cases which they studied lacks the discipline of a consistent theory.

[2] *The Economic Journal*, Vol. LVIII, No. 231, September 1948, p. 416.

of funds for investment, at the same time permits this divorce. It is observed that the funds pass into the control of the board of directors. So it is said that the board becomes the steward of the corporate funds.[1]

3. How are we to translate " steward " into economic terms associated with entrepreneurship ? Though to a greater or less extent disburdened of risk-bearing, the board might still retain the maximising function, and operate as maximising centre. We might tentatively assume that stewardship is to be interpreted in this way. The board would then be involved in the planning processes which included the selection of alternative courses of action and their results, and the cost/revenue calculation (budgeting) involved in the determination of the optimum plan and its results, including the anticipated account, or budget. The board would select the optimum plan and proceed to secure its execution : the plan, including the figures of the operating budget, would become standing orders defining the powers, duties and limits of freedom of members of the organisation who were to execute the plan. An account of actual operations, in a form corresponding to the operating budget, would then fall logically into place as a report to the board that the standing orders had, or had not, been carried out.

4. To understand the need for the maximising centre, where there is delegated decision-making, it is necessary to understand the distinction between the situation in which a single person both makes and also himself executes all the decisions which are oriented towards the achievement of his values, and the situation in which there is an organisation of people whose decisions and activities are oriented towards a common goal. In the one case, the physical and psychological integrations[2] of the single brain and/or mind[3] bring about the plan, decision, and action to carry out the decision

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[1] *Vide* Copeland and Towl, *op. cit.*, p. 3.

[2] The terms " integrations ", " organisationally rational ", " communication ", " co-ordination ", " procedural co-ordination " and " substantive plan " in this section are terms used by Professor H. A. Simon in his *Administrative Behavior* (New York, The Macmillan Company, 1948), a work which, in my opinion, constitutes a great advance in the direction of providing the missing theory referred to in the first paragraph of this article, and which clearly comprehends the relevance of certain economic concepts, and makes use of them.

[3] I do not know where one leaves off and the other begins, and I doubt whether anybody else does.

(execute the plan). In the other case, in so far as the integrations are necessarily interpersonal, a substitute has to be found for what, in the first case, is performed by the single human brain and/or mind.

A very simple example,[1] which may be taken for illustrative purposes, is that of a partnership organised for the purpose of buying and selling product *X* with a view to maximising net revenue. A is to buy and B is to sell: the partnership (the organisation) relies upon A's prescience in the buying market and B's prescience in the selling market. In this situation, for there to be organisationally rational behaviour, there must be *ex ante* comparison of A's purchases schedule and B's sales schedule, performed either by A's submitting his schedule to B, or vice versa, or by each of them submitting his schedule to a committee of A and B. In other words, there must be *ex ante* communication of members' plans, with variations (alternatives)[2] in each, to a maximising centre, for the purpose of selecting, by the process of co-ordination, the optimum plan for the organisation. The construction of schedules by A and B, and the comparison of the schedules to select the optimum purchases/sales figure, may be called budgeting.[3] The anticipated results chosen by the maximising centre (i.e., the anticipated results in the optimum position indicated by the schedules) may be called the operating budget—so much of product *X* to flow into and out of the organisation, so much money to flow out in payment for purchases of *X*, and so much money, as revenue, to flow in. Each of these quantities may be settled as a definite quantity plus or minus a definite permitted variation, i.e., as a quantity variable within tolerance limits. The decision of the maximising centre simultaneously selects that variation of A's (B's) plan and budget which A (B) is to operate. To the extent that it affects A's (B's) part of the plan, there must, therefore, be communication of the decision to A (B). A subsequent account[1] of operations, corresponding in form to the budget,[2] would show whether or not, within the tolerance limits set, the organisation's budgeted results had been achieved. The arrangements to secure the interpersonal integrations (the communication to and from, and the functioning of, the maximising centre, and so on) may be called the organisation's procedural co-ordination arrangements. These, together with the substantive plan (the plan of the work to be done by the organisation), including the budget, may be regarded as the organisation's standing orders.

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[1] A somewhat more elaborate model, with a fuller discussion of the maximising process, is contained in G. F. Thirlby, "The Subjective Theory of Value and Accounting 'Cost'", *Economica*, New Series, Vol. XIII, No. 49, February 1946. It appears to be consistent with much of the doctrine of H. A. Simon (*op. cit.*).

[2] Indicated by the expression "schedule". If a member's plan is called a "subset" (Simon, *op. cit.*) of the organisation's plan, these variations are alternative subsets.

[3] The relations between budgeting, the budget and the account are discussed in G. F. Thirlby, *op. cit.*, and in G. F. Thirlby, "The Ruler", *The South African Journal of Economics*, Vol. 14, No. 4, December 1946. It is worth noticing that if the goal-oriented organisation in question were the collectivist state, the maximising centre's budget and account would be the "national" budget and "national" account. But a model of these things, without a model of the budgeting or maximising process, would be a grin without a cat—and the cat is not easy to construct!

It is necessary to introduce a slight modification of this partnership organisation, in order to indicate what is meant by later references to " proximate co-ordinators ", and by reference to the idea that the maximising centre may be unconscious of some of the decision-making in the remainder of the organisation. A and B will be to some extent unconscious of the foundations of each other's market anticipations : the assumption that they rely upon each other's prescience suggests as much. With extended delegation from the maximising centre outwards, the members of the maximising centre may become increasingly unconscious of the detail that the centre co-ordinates—and may even be unacquainted with some of the members responsible for that detail. Suppose, for example, that B's work is partly delegated to C, and C's partly delegated to D, B relying upon his own prescience with respect to market S_1, and upon C's with respect to market S_2, and C relying upon his own prescience with respect to part of S_2, and upon D's prescience with respect to the remainder of S_2. Clearly, D's sales schedule will have to be co-ordinated with C's (presumably by C, who becomes D's proximate co-ordinator), and the co-ordinated schedule with B's (presumably by B, who becomes C's proximate co-ordinator), before this second co-ordinated sales schedule is finally co-ordinated with A's purchases schedule at the maximising centre—which is the proximate co-ordinator to A and B. Both A and B could conceivably be unconscious not only of the foundations of D's market anticipations, but also of the detail of his schedule—and they could conceivably be unacquainted with D himself. None the less, D's prognostications would be affecting the final sales figure settled at the maximising centre, and the maximising act laying down the sales figure as part of standing orders would operate as a determinant of D's activity in executing his part of the organisation plan.

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[1] If the administrative decision is regarded as containing a hypothesis to the effect that, if the accepted course of action is taken in a certain situation of time and place, then there will follow certain results which will be empirically checkable, the budget may be regarded as a description of those expected results, and the account as a description of the check. This would mean that, for this purpose, the account would describe only such results as could be checked in that way.

[2] Nothing in this section is intended to suggest that the budget, or any communication to or from the maximising centre, or, for that matter, the account, is necessarily committed to writing.

5. A fuller treatment of the theory of the functioning of the organisation would have to consider how much of the planning process is implied in the much used expression "policy-making". If we follow Simon[1] in distinguishing the value judgment in decision-making from the factual judgment of the administrator, the expression "policy-making" should, I think, be reserved to denote a value judgment converted into its corresponding imperative (e.g., "To maximise net revenue is good. Maximise net revenue!").[2] To restrict the definition in this way, and so, perhaps, in principle, to throw a company's policy-making back to the stockholders, would still leave administration (the determination of the course of action to achieve the goal set by policy) within the function of stewardship that I have suggested. In other words, the board of directors might still be regarded as the maximising centre. I shall, therefore, omit further use of the term "policy", until, in section 15, I attempt a short explanation of how "policy-making" comes to be attributed not only to the board, but also to the "executive" organisation beneath it.

6. If, then, the board were the company's administrator-in-chief, and were acting as the maximising centre whose function is suggested in section 4, what part would the so-called "executive" organisation beneath it have to play in administration? This is a question which we have to examine carefully if we are to understand how the functioning of the board is to be rationally integrated with the functioning of the remainder of the organisation.

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[1] *Op. cit.*

[2] This, as I see it, is the policy-directive which it is common for economics implicitly to assume to be issued by the entrepreneur to himself. That it is not a completely satisfactory directive becomes evident in practice when the policy-directive is given by one person to another, i.e., when there is delegation of administration. Two time-series of outlays and revenues may give the same total outlays and the same total revenues, while the outlays and/or the revenues may be differently distributed over time. Selection between these two time-series involves a relative valuation, and requires an elaboration of the policy-directive.

Although the board's plan and budget, as standing orders, would control the activities of the " executive " organisation beneath it, this fact does not mean that people operating within the " executive " organisation would always at all times be merely carrying out the rigid standing orders exactly defined by the board, never themselves selecting between alternative courses of action or making decisions. Initiative may be exercised : (*a*) within the tolerance limits allowed by standing orders ; (*b*) in the planning process leading to the board's decision which lays down standing orders.

(*a*) It is perfectly feasible that standing orders should allow tolerance limits, both with respect to expenditures and revenues, and with respect to spheres of activity.[1] For example, an administrator[2] subordinate to the board might be permitted by standing orders to spend a sum, variable within certain limits (a tolerance) upon product A, providing he returned a revenue, variable within certain limits (another tolerance) within a certain time.[3] Product A might consist of a range of sub-products. The permitted variation within this range (the tolerance with respect to the sphere of activity) might be defined. The subordinate administrator would thus have a range of discretion within which he could vary the plan which he had in mind when the standing orders were laid down. In observing these standing orders, he is then behaving as an executive of the maximising centre (the board—his proximate co-ordinator) which has laid them down ; yet he is also an administrator making his own decisions within the tolerance limits. Similarly, a person may behave as an executive of a maximising sub-centre—his proximate co-ordinator—and yet be an administrator within a permitted range. That is to say, limited scope may be left for "day-to-day" adaptation to changing anticipations, without reference back to a proximate co-ordinator. Other changes in anticipations may warrant reference back to a proximate co-ordinator: changes of such a nature as to render likely a variation, outside the tolerance limits, from the plan originally accepted by the proximate co-ordinator, which consequently require to be co-ordinated by him with the plans of other persons subject to his co-ordination. Such changes may, or may not, have repercussions involving reference back, from a co-ordinator remote from the board, to a co-ordinator nearer the board.

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[1] This is not intended to suggest that the definition of the limits is simple, or that my example is anything more than an oversimplification of the problem as it would often be presented. The intention is primarily to present the logical position : *ex ante* co-ordination implies the report back, for co-ordination, of a subordinate administrator's intention to vary his part of the co-ordinated plan ; the co-ordinator may decide that what will be lost (in organisation goal-achievement) by relaxing the condition will be more than gained by obviating the labour and frustrations of constant re-co-ordination ; but unlimited relaxation negatives the principle of *ex ante* co-ordination. (There is no " objective " determinant of the appropriate compromise.) A secondary intention is to present a situation which takes care of the common attribution of " day to day " decisions to the " executive " or " operating " organisation.

[2] Who might, of course, be a director. It is possible for a member of the board to be also a decision-maker subordinate to the board. (See section 12 below.)

[3] This example resembles that in G. F. Thirlby, " The Subjective Theory of Value and Accounting ' Cost ' " (*loc. cit.*). Contrast the example in section 4 (above) where the subordinate administrator A does not sell what he buys, and the subordinate administrator B does not buy what he sells.

Two aspects of the matter of the definition of limits warrant parenthetical notice. The first relates to the definition of the sphere of activity. In default of careful definition—which may not be easy—when the standing orders are laid down, difficulties may arise subsequently as to what is and what is not a significant deviation from standing orders in this respect, raising questions for settlement by the decision-maker's proximate co-ordinator, e.g., the board. Careless settlement (careless "precedent"-making) may inadvertently modify standing orders, or the observance of them, and, in so doing, extend the decision-maker's sphere of activity.

The other aspect of the matter of the definition of limits that requires to be stressed is that, whether the limits are limits of spheres of activity or limits of expenditure and revenue, the definition does depend upon a *decision.* The emphasis is necessary because of the common propensity to look for objective criteria which would define the limit apart from decision. It is not satisfactory to suggest, for example, that the decision to erect a new plant is obviously a board decision, or to attempt to distinguish, by enumeration of such instances, what decisions lie outside the sphere of others, e.g., the "chief executive". It would be easy to cast doubt on the satisfactoriness of the distinction on the ground that plants are of all sorts and sizes, and of all ranges of physical durability, and that it is difficult or impossible to distinguish between parts of plants and whole plants (or between maintenance and replacement). But this criticism is not the fundamental criticism at all. The point to be emphasised is that the limit of the sphere of activity, or of the expenditure, if the "new plant" is translated into that, does not define itself, and is not empirically discoverable apart from the decision which defines it. In other words, the "objective facts" which delimit the "chief executive's" liberty of action with regard to the acquisition and use of plant are the decisions which have been made about that liberty of action by his proximate co-ordinator. These decisions may include one that he shall not erect a new plant (defined in some way, implicitly or explicitly). But it is the decision about the situation that is the criterion. It is not the physical situation "erection of a new plant" that makes a decision about it one which obviously rests with the board: all that makes it so rest is *the existence of another decision*, to the effect that a decision about the erection of a new plant shall rest with the board. The only objective demarcation of limits of expenditures and revenues and spheres of activity is a decision that there shall be such demarcation.

(*b*) Initiative may be exercised by the "executive" not only within the tolerance limits allowed by standing orders, but also in the planning process leading to the board's decision which lays down the standing orders. It is perfectly feasible that the person who is allowed the discretion within the tolerance limits should take part in the maximising process, i.e., in the tentative decision-making antecedent to the final act of co-ordination which lays down the standing orders. In the example given in (*a*), the board, by its co-ordinating act, allocates certain funds to the subordinate administrator, and defines his sphere of activity in a certain way, after deciding that to do so will accord with the optimum use of funds. In so doing, the board will be relying upon the subordinate administrator's prescience and tentative decisions concerning his use of funds and his sphere of activity. Thus the *ex ante* co-ordination occurs without denying initiative and administrative activity within the body of the organisation.[1]

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[1] The final co-ordination of plans by the board is suggested in a case (Copeland and Towl, *op. cit.*, pp. 73 and 74) in which the final procedure at board meetings is described by a director as "a meeting of all minds" (following discussion and modification of plans by directors and executives). Though certain words ("Even then we do not make specific decisions, because it is an executive function to be performed at the time of action") suggest that no decision is made by the board, it seems to be implied in the "meeting of all minds" that agreement is reached between the board and the executive upon the broad limits within which the executive, in its upper reaches, has freedom of action, and that the "specific decisions" may be deemed to refer to the constituent decisions which are sanctioned by the board's co-ordinative decision, but whose subsequent modification might occur, within limits, without any infringement of the overriding standing orders.

7. We may now isolate (*a*) those decisions falling within the scope of subordinate administrators[1] (including maximising sub-centres), and so, by a process of elimination, isolate (*b*) the decisions falling within the scope of the final maximising centre (board decisions).

(*a*) Board decisions may be said to *ex*clude:

(*i*) Any decision which, in spite of being a variation from a tentative decision made for the purpose of, and confirmed by, the co-ordination process, would not be a variation of sufficient effect to involve breach of the existing standing orders issued from the particular decision-maker's proximate co-ordinator, and consequently would not require reference back at all.

This is a decision falling within the tolerance limits allowed to the particular decision-maker. For example, a subordinate administrator may decide to invest more in one product, and less in another, than he expected to invest when he budgeted for funds. He may not have had to disclose how much he intended to invest in each product, and his revised decision need not carry him outside his tolerance limits.

(*ii*) Any decision which, to avoid breach of standing orders, did require reference back to a co-ordinator proximate to the decision-maker but intermediate between the decision-maker and the board, whether or not the decision would involve a variation of sufficient magnitude (or sufficient trespass outside a permitted sphere of activity) to involve ultimate reference back to the board itself.

If it did involve such ultimate reference back, the decision referred to the board would not be the decision of the particular decision-maker, but the decision of the co-ordinator who reported direct to the board. The co-ordinator's decision might be a quite different one, because a co-ordinator's sanction of a subordinate administrator's decision may be accompanied by other adjustments made as part of the co-ordination process. It is the co-ordinator's decision involving the whole readjustment that may require sanction from the still higher co-ordinator. Suppose, for example, that a co-ordinator wishes to grant extra funds to a particular administrator. Whether he applies to a higher co-ordinator for extra funds and, if he does so, the sum for which he applies, may depend upon whether the money drawings of other administrators to whom he is co-ordinator are, on the whole, now expected to approach the upward or the downward limits of their tolerances.

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[1] Who may include individual directors. (See section 12 below.)

(*iii*) The new tentative decision of any decision-maker (co-ordinative of the activities of other decision-makers or otherwise) due for submission to a proximate co-ordinator other than the board (i.e., a co-ordinator intermediate between the decision-maker in question and the board) at any recognised time for general budgeting.

This is a decision similar to that under (*ii*). It relates, however, to the decision-maker's whole plan for a forthcoming budgetary period, while that under (*ii*) relates to an adjustment in his plan during a budgetary period. An example would be that of a subordinate administrator submitting expenditure and revenue estimates (with variations), for the forthcoming period, to his proximate co-ordinator (other than the board).

(*b*) Board decisions would then *in*clude any co-ordinating decision dealing with any tentative decision, actual or implied, which, being a tentative decision of a decision-maker to whom the board is proximate co-ordinator, would, if made without reference to the board, be made in breach of the board's existing standing orders limiting the activities of that decision-maker. (The word " implied " is inserted to cover sufficiently effective action taken by that decision-maker's subordinate decision-maker acting *ultra vires* standing orders.) Board decisions would clearly include also the new tentative decision, of that same decision-maker, due for submission to the board at any recognised time of general budgeting.

8. It is thus possible for the board as maximising centre to be unconscious both of some of the subordinate decisions upon which its own plan is built up, and upon which its own decision depends, and also of some of the subsequent modifications of subordinate decisions. Possibly it is the presence of this unconsciousness at the centre which has given rise to the idea in the minds of commentators on internal organisation that the details of operating management are the province of the executive rather than the board : that the work of operating management is delegated to the " chief executive ", and by him to his subordinates. The idea is, however, obscure : the division between what is and what is

not delegated is not clear ; neither is the means of co-ordination. If the board as maximising centre delegates part of the administration to an " executive ", the administrative acts of the " executive " require to be co-ordinated, by the board, with other parts of the administration, in order to secure consistency between one administrative decision and another, and consistency of decisions with maximum goal achievement. If the organisation is one which provides for this delegation and co-ordination of decision-making, it might not be untrue to say that a purpose of the delegation is to facilitate the making of decisions—by disburdening the centre of the delegated planning operations—but it would be negligent to omit reference to the co-ordination and its purpose. Clearly this co-ordination must occur in the planning stage, and not after the activities have occurred. The board thus becomes the centre towards which plans move for co-ordination, at which the co-ordinated production plan and operating budget are finally settled, and from which issue standing orders regulating the organisation's production activities.

If, then, there is delegation of (part of the) administration, co-ordination of the parts is required to secure consistency. If, on the other hand, there were no delegation of administration, " executive " responses would be fully planned at the centre : the " executive " part of the organisation would be one calculated merely to secure the execution of plans.

9. It might, of course, be argued that the board delegates the *whole* of the administration to the " chief executive ", and consequently that the view that the board is the maximising centre is falsified : that the " chief executive " becomes, in effect, the steward's steward. While it could be retorted that to appoint a sub-steward in this way still involves an *ex ante* co-ordinating (or maximising) act (a choice from among persons of the one best fitted to maximise the organisation's goal achievement), the retort invites the rejoinder that this act is precisely similar to the act of the stockholders in appointing the board, and that consequently we ought to have regarded the stockholders as the maximising centre in the first place.[1] The rejoinder is perfectly sound. The

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[1] While we might have considerable sympathy with the view that the stockholders ought to be regarded as the maximising centre, we must recognise what would be involved in their so functioning. The meeting of stockholders would settle the overriding budget and its tolerance limits. The tolerance limits could not then be exceeded without either breach of standing

criticism of the view that the board is the maximising centre has to be met in another way. Its being so regarded did not depend merely upon its choosing a person or committee of persons which it expected to bring about maximisation of the organisation's goal-achievement ; it depended upon its *being acquainted, ex ante, with the description of the expected results of the actions* of persons who were expected to bring about those results, and upon its choosing those results in preference to the results of alternative plans. Whether the board is the maximising centre in this sense, or whether it relieves itself of the function by appointing a sub-steward, is admittedly a question of fact.

10. The description of the expected results of the actions of the members of the organisation is, or is to a greater or less degree reflected in, the organisation's budget.[1] It is this budget that we should expect to be recognised as an essential constituent of the standing orders thrown up as the essential result of the final co-ordinating act of the co-ordinating centre (the board) ; and therefore it would be regarded as the means whereby the board subsequently discovered, by comparison of the projected results with the actual results, whether or not its approved plan of operations had been substantially carried out.[2]

The budget would not be something which was merely submitted to the board for its information. If the board were functioning as the maximising, or final co-ordinating, centre, where the production plan was finally co-ordinated and established, the budget's final emergence as standing orders would be a resultant of the activity of the board itself, and the budget something of which the board would have to be presumed to be necessarily cognisant when it emerged. It should hardly be necessary to add that an

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orders, or, alternatively, a meeting of stockholders called to rebudget. (By analogy, " the public " would have to meet to settle and revise the " national " budget !) I should add that I am perfectly well aware that the decision of the maximising centre (be this the meeting of stockholders or the board) could widen the tolerance limits to an extent which would render the settlement of the budget a fiasco. (Cf. footnote 1, page 271.)

[1] It still does not follow that the budget is committed to writing. (Cf. footnote 2, page 269, and section 13.)

[2] The operating budget (as defined by them) is regarded by Copeland and Towl as " another device which can aid a board of directors in making an over-all review of a corporation's affairs " (*op. cit.*, p. 80), but as " not an indispensable means, of course, of checking up on results " (p. 81). None the less, they assert that " the board cannot divest itself of the responsibility . . . for ascertaining whether the results are the ones which were anticipated " (p. 82), and observe that " the checking-up process presupposes that there is something on which to make a check " (p. 85).

account of actual results cannot be used by the board for comparison with a budget if there is no budget with which to compare it.

11. Given that the board is the maximising centre, at what times, and in what circumstances, will it be prompted to budget and rebudget ? It will presumably budget at its own inception, at such intervals as it determines, and whenever a subordinate administrator to whom the board is proximate co-ordinator reports a change in his anticipations of a magnitude defined as significant by existing standing orders—a change, in other words, which prompts him to make a decision which would carry him outside his defined tolerance limits. For appropriate response to change occurring within that subordinate administrator's sphere, *the board will then be dependent primarily upon the subordinate administrator's report of any such significant change in his anticipations*. It should be noticed that as the subordinate administrator's budget (or forecasted account) is at any time contained, or implicit, in the declaration of his anticipations at the determined level of operations, and as he now has a prime duty to report significant changes in his anticipations (and hence in his forecasted accounts), actual accounts should conform to revised budgets.[1] The same principle applies to the relationship between a maximising sub-centre and the administrators whose activities it co-ordinates.

12. Membership of the board (directorship) does not, of course, imply either that the director has no personal contacts with non-director members of the organisation, or that he cannot himself be a member of the organisation in another capacity.

If he is to have confidence in their estimates, any member of any co-ordinating centre is likely to require access to the subordinate administrators to whom the centre is proximate co-ordinator. It may be regarded as part of the function of the board to grant a director this access, either at formal board meetings or otherwise. The board may grant him similar access for the purpose of offering criticism and advice to other members of the organisation regarding projects for which they are responsible, whether or not the projects require to be overtly submitted to the board.

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[1] Nothing here or elsewhere in this paper is intended to suggest that the conformity of a subordinate administrator's account with his budget is a final confirmation of his administrative perfection. Proof that he had bought his budgeted quantity of goods at his budgeted price, for example, would not disprove that he had negligently paid a higher price for the goods than he need have done. Whether this negligence would amount to inefficiency, organisational irrationality or some other kind of failing, is a question which would require the space of another article to consider.

The director may be still more closely linked with the functioning of the remainder of the organisation in that he may himself be also an administrator subordinate to the board, contributing a prescience like any other subordinate administrator. (Cf. A or B in the partnership organisation in section 4.)

13. The matters which we have discussed are mainly matters of procedural co-ordination. The distribution and integration of decision-making, and the production of budgets and accounts, that have been the subject of discussion, are what we might expect the company's procedural co-ordination arrangements to bring about. Procedural co-ordination arrangements are implicit in any situation which can be regarded as a rational organisation. This is not to say that the process of substantive co-ordination cannot occur informally, i.e., without formally determined procedural arrangements. It might occur quite informally, the participants not being acutely conscious that they were performing a co-ordination process, but just discussing business with one another from time to time, and accommodating one another by making adjustments in their plans and activities. Recognition of the procedural arrangements, or the need for their recognition, is likely to occur when an organisation outgrows the possibility of informal adjustment, or when an organisation has at the outset so many members, or members so unacquainted with one another, and one another's activities, that the informal adjustment would not be likely to occur. Then the problem of securing consistent behaviour arises. What has to be secured is a situation in which, while many mutually consistent decisions, tentatively made by subordinate administrators, are implicit in, and simultaneously confirmed by, an *ex ante* decision of a co-ordinator (or co-ordinating committee), the co-ordinator himself (or any member of the co-ordinating committee) is unconscious of part of them.

14. To understand this process of delegation and co-ordination, and its practical difficulty, may help us the better to understand how, when what has to be co-ordinated becomes highly complex, the organisation tends to be

overridden, and perhaps destroyed, by one or other or both of two forces moving in opposite directions: either through the enterprising, or recalcitrant, subordinate acting *ultra vires* standing orders, or through the determined superior allowing his action to be dominated by the authoritarian view.

The authoritarian view substitutes omniscience, or omniprescience, at the centre for distributed prescience co-ordinated at the centre. The authoritarian view would be tenable only in conditions in which all the administrative decisions were conscious decisions of the central co-ordinating body, and in which the only delegated "decision-making" (a misleading term in the circumstances) was mere response to this central authority's standing orders which completely and explicitly described the response before it occurred.

15. In section 5, reference was made to the expression "policy-making". Now that we have observed the board as maximising centre, we are in a better position to explain why the function of "policy-making" tends to be attributed primarily to the board, while at the same time the "executive" organisation is regarded as sharing in it.[1] When the board as maximising centre makes the co-ordinating decision which settles standing orders for the decision-makers to whom the board is proximate co-ordinator, these standing orders become decisional premises for those decision-makers when they are executing the plan, and making decisions falling within their tolerance limits. From their viewpoint at this time, therefore, the standing orders may appear as policy (i.e., something which to them is a goal approved and set by the board for their achievement), even though the act of the board in making the co-ordinating decision is not the fundamental policy-making act, but an administrative act aimed at the goal which it is the policy of the organisation to achieve—e.g., the goal of net revenue maximisation referred to in section 5. In the same way, decision-makers remoter from the centre may view decisions issuing from their proximate co-ordinators as policy-making decisions, even though those decisions, too, are administrative decisions.

But these people, whose planning behaviour is subject to co-ordination by the board or some other co-ordinating centre, themselves made the tentative administrative decisions which were the subject of the co-ordinating act leading to what has now come to be regarded as policy. Hence, these people (the " executive " organisation) may come to be regarded as taking part in policy-making.

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[1] *Vide* Copeland and Towl, *op. cit.*, *passim.* I found extreme difficulty in attempting to divine what meaning Copeland and Towl attached to the expression "policy", and what part of "policy-making" they deemed to be the preserve of the board.

If, now, both these tentative administrative decisions, and also the co-ordinating decisions, are regarded as policy-making decisions, and if the two together are regarded as exhausting policy-making (so omitting the value judgment setting the organisation goal—referred to in section 5) policy-making becomes equivalent to the (administrative) maximising process as a whole.

16. This discussion began with the suggestion that the conception of the one-man-entrepreneur was unsatisfactory. It concludes on the same note. The market exchange relationship is not the only interpersonal relationship involved in economic equilibration. This remains true even though we include in exchange the exchange of " labour " (or any other factor) for the remuneration for its service in production. The interpersonal relationships between those persons who go with their services to co-operate in productive activity do not consist merely in their bargaining with one another about their several remunerations. Neither do their decisions consist merely in decisions whether or not to co-operate. During the period of co-operation, each one (unless his behaviour is a mere response to somebody else's decision) has to make decisions concerning the adjustment of means to achieve the organisation's ends. To assume that all these decisions are made, and their results absolutely determined, before, or simultaneously with, the making of the contracts to co-operate, would be as absurd (as an explanation of the behaviour of most organisations) as to assume (for the same purpose) that the behaviours of all but one of the members are responses absolutely determined by the decisions of the remaining one. There is, therefore, something left to explain. The assumption of a common goal and the principle of rationality implies that, during the period of co-operation, each decision of each member is integrally connected with the decisions made simultaneously by all other members. As theorists, we have, I think, to try to describe this integral connection by attempting to construct a functioning organisation ideationally, and then, or incidentally, to try to explain under what external (market)

conditions, under what internal conditions (including procedural co-ordination arrangements), and with what definition of goals (policy decisions) the assumptions (of common goal and organisational rationality) are likely to be valid, and the organisation goal likely to be achieved. Now that the goal-oriented organisations include (supposedly at least) not only the joint-stock company, but also the public utility, the nationalised industry and the collectivist state, the problem has become one of more than theoretical significance.

This paper does no more than suggest a little of the necessary treatment.

The London School of Economics.

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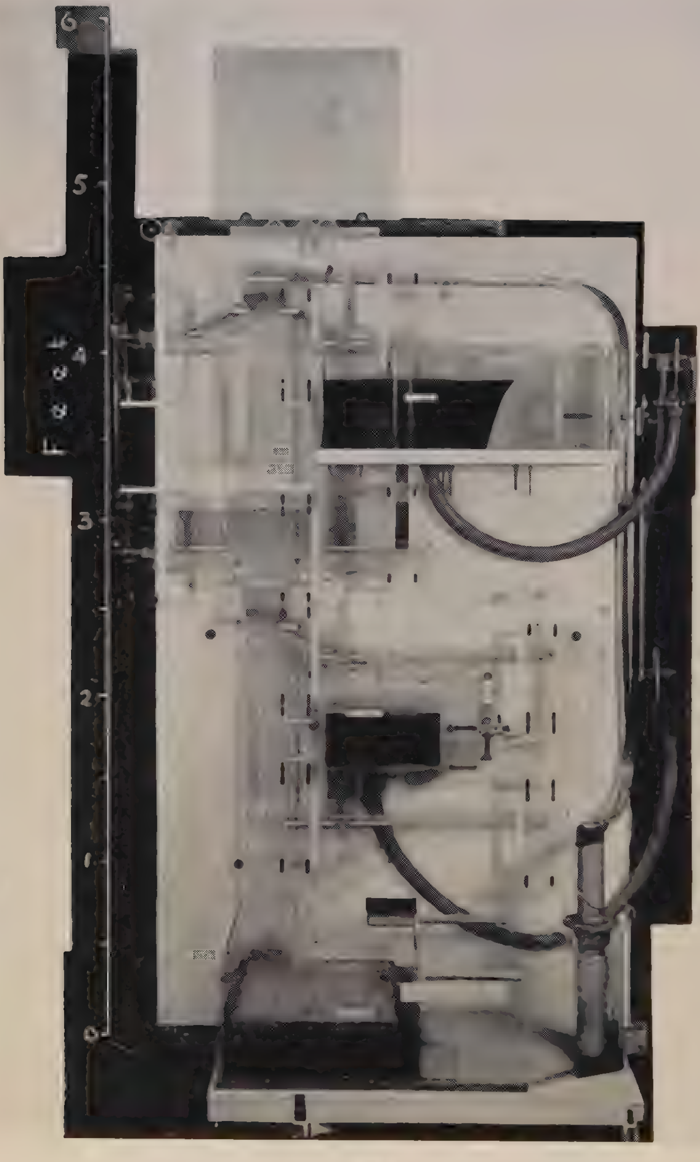

FIG. 1.

Mechanical Models in Economic Dynamics[1]

By A. W. Phillips

There has been an increasing use in economic theory of mathematical models, usually in the form of difference equations, sometimes of differential equations, for investigating the implications of systems of hypotheses. However, those students of economics who, like the present writer, are not expert mathematicians, often find some difficulty in handling these models effectively. This article describes an attempt to develop some mechanical models which may help non-mathematicians by enabling them to see the quantitative changes that occur in an inter-related system of variables following initial changes in one or more of them. One model (see photograph in Fig. 1) has been made for the University of Leeds, a second and improved version is now being made for the London School of Economics.

I

Fundamentally, the problem is to design and build a machine the operations of which can be described by a particular system of equations which it may be found useful to set up as the hypotheses of a mathematical model, in other words, a calculating machine for solving differential equations. Since, however, the machines are intended for exposition rather than accurate calculation, a second requirement is that the whole of the operations should be clearly visible and comprehensible to an onlooker. For this reason hydraulic methods have been used in preference to electronic ones which might have given greater accuracy and flexibility, the machines being made of transparent plastic (" Perspex ") tanks and tubes, through which is pumped coloured water. The accuracy obtained depends on the precision with which the machines are constructed, but there is no difficulty in keeping it within about ± 4 per cent.

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[1] I wish to thank Mr. W. T. Newlyn, in co-operation with whom the original model was made, for his valuable assistance in design and construction. An article by Mr. Newlyn, based on his experience in using the model at the University of Leeds, will be published in the *Yorkshire Bulletin* in September, 1950. I also wish to thank Professor J. E. Meade, who suggested a number of improvements in the theoretical model and methods by which they might be included in the mechanical one. I am grateful to the London School of Economics for financial assistance which has enabled me to devote the last six months to developing the model.

I am greatly indebted to Mr. and Mrs. R. W. Langley for their willing and generous help in the construction of the first machine.

Both of the models mentioned above deal with macro-economic theory in terms of money flows ; but they are based on an analogy given by Professor Boulding[1] to show how the production flow, consumption flow, stocks and price of a commodity may react on one another. Before describing them it will be convenient to show how Boulding's qualitative model can be developed to make the values of the variables and the relationships assumed to hold between them quantitatively precise and to enable shifts in these relationships to be introduced.

In the model shown diagrammatically in Fig. 2, the production flow of a commodity is represented by the flow of water into a tank. This flow is controlled by a valve, consisting of a flat plate sliding horizontally over a narrow parallel slot. The head of water over the valve is kept approximately constant by an overflow weir at a fixed height above it, so that the rate of flow of water through the valve is proportional to the length of slot uncovered, and can be measured by a linear scale attached to the valve. The production flow goes into the tank containing stocks, from which is drawn the consumption flow, controlled and measured by a second valve similar to the first. The small float in the consumption tube maintains a constant head of water over the valve, irrespective of the level of water in the tank and of the consumption flow.[2]

Price is assumed to be determined at any instant by the quantity of stocks, represented by the quantity of liquid in the tank, and the demand schedule for them, represented by the capacity of the tank at different levels, and is therefore shown inversely by the height of water in the tank. The tank is rectangular except for one end, the shape and position of which are derived from the demand curve for stocks so as to reproduce on the machine the relationship assumed or found to hold between stocks and price of the commodity. This end of the tank, though water-tight,

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[1] *Economic Analysis*, Revised Edition, 1948, p. 117.

[2] The actual constant-level float mechanism used, though similar in principle, differs in construction from that shown.

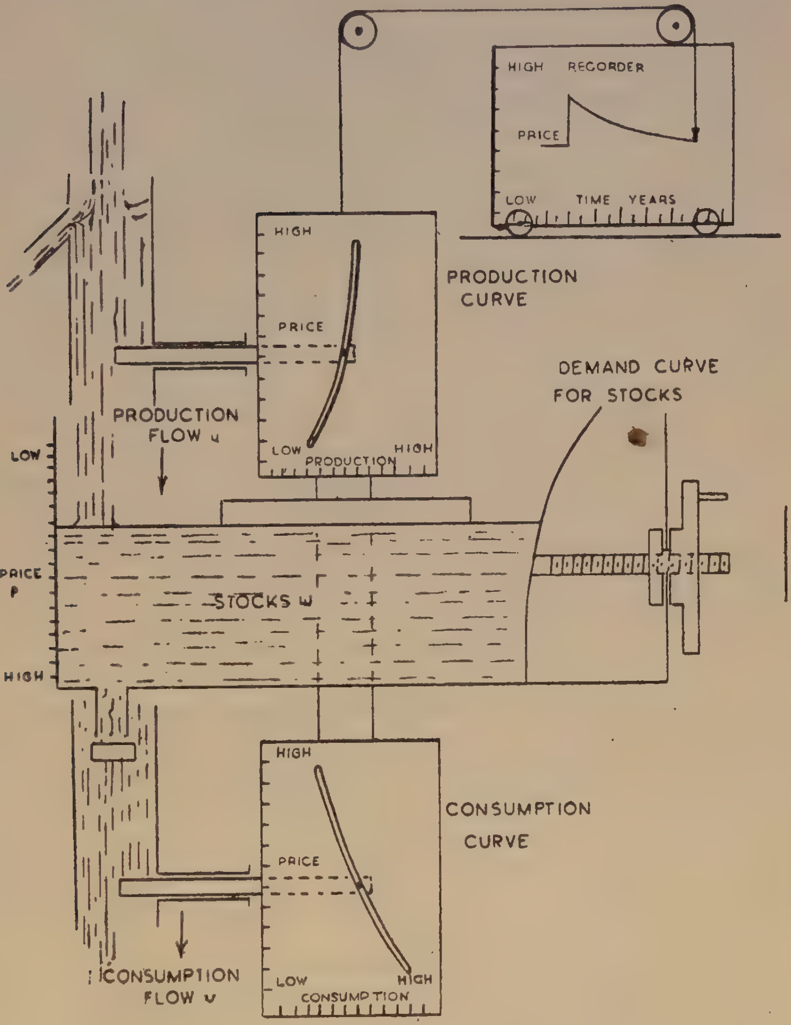
HIGH
RECORDER
PRICE
LOW
TIME YEARS
HIGH
PRICE
LOW
HIGH
PRODUCTION
PRODUCTION CURVE
DEMAND CURVE FOR STOCKS
PRODUCTION FLOW u
LOW
PRICE p
STOCKS w
HIGH
HIGH
PRICE
LOW
HIGH
CONSUMPTION
CONSUMPTION CURVE
CONSUMPTION FLOW v

FIG 2.

slides freely when the hand-wheel is turned, enabling a shift in the demand curve for stocks to be introduced.

Attached to a float on the tank is a bar, free to move vertically between guides, and carrying two graphs, a production and a consumption curve, which move in front of their respective valves. Each graph is made by cutting a narrow slot in a thin sheet of plastic; a pin projecting from the end of the valve engages in this slot so that when the float moves the graph vertically, the graph moves the valve horizontally, opening or closing it according to the shape of the curve. The graphs are attached to the bar by spring clips and can be moved in any direction to enable shifts of the production and consumption functions to be introduced. Price can be read off a linear scale (the correct way up) marked along the ordinate of each graph, against a cursor line engraved along the side of the valve.

Given the dimensions of the tank and the valves, the choice of units for the scales determines a time constant for the model. This is perhaps most easily shown by an example. Assume that the price scale is so chosen that the required relationship between stocks and price of a commodity is reproduced on the model when one cubic inch of water is made equivalent to one hundred tons of the commodity. Assume also that the valves are so designed that for every inch of valve opening there is a flow of one hundred cubic inches of water per minute, equivalent to ten thousand tons of the commodity per minute of time on the model. If now scales marked ten thousand tons per year per inch of valve opening are chosen as being most suitable for the actual magnitudes of the production and consumption flows, a time constant has been fixed making one minute of time on the model equivalent to one year in reality. Having determined a time constant it is possible to record the path of the price change induced by a shift in one of the curves. The recorder consists of a clockwork mechanism, carrying a plate to which a chart can be attached, and moving towards the left along rails, at the rate of one inch per minute. With a time constant of one minute equalling one year, the abscissa of the chart can be marked off with a scale of one inch equal to one year. Against the chart rests a recorder pen connected to the graph bar by a thread so that it moves vertically with price, which may be marked along the ordinate of the chart. The pen then traces out a graph of price against time in years. Similar recorders could of course be fitted to the other variables.

It is easy to see from the diagram the results of a shift in one of the functions, from an equilibrium position. A spontaneous increase in consumption (shift of the consumption curve to the right) will result in a gradual decrease in stocks and rise in price. The price rise will induce a contraction of consumption and extension of production (movements along the curves) until a new equilibrium is established with higher values of consumption, production and price than at the previous equilibrium position. A spontaneous increase in production (shift of the production curve to the right) will induce a gradual change to a new equilibrium position, with higher values of production and consumption and a lower price than before the change. A spontaneous increase in the demand for stocks (a shift of the demand curve for stocks, or the end of the tank, to the right) will cause an immediate rise in price and production flow, and a fall in consumption flow. Production now being higher than consumption, stocks will gradually rise, inducing a gradual fall in price and production and a rise in consumption until production and consumption are equal again. If there has been no shift in the consumption and production curves this equality will only be reached when stocks have risen sufficiently to bring the price, and also the production and consumption flows, back to their original values. The shape of the graph of price against time drawn by the recorder will be something like that shown in Fig. 2.

This illustrates an interesting point. Although, on the assumptions of this model, it is correct to say that at every instant of time price is determined only by the quantity of stocks and the demand for them, yet it is also correct to say that the long-term trend of the price is completely unaffected by shifts in the demand curve for stocks, being determined only by the position of the production and consumption curves, i.e., the "flow" functions.

The hydraulic model will give solutions for non-linear systems as easily as for linear ones. It is not even necessary for the relationships to be in analytic form: so long as the curves can be drawn the machine will record the correct solutions, within the limits of its accuracy. In giving the equivalent mathematical model, however, the usual linearity assumption will be made, in view of the difficulty of working with non-linear differential or difference equations.

Let u be the production flow, v the consumption flow, w the stocks and p the price, all measured, for simplicity, from a base at which the system is in equilibrium. We have then, by definition, the identity,

$$u - v = \frac{dw}{dt},$$

and three hypotheses,

$$u = lp$$
$$v = mp$$
$$\text{and } w = np,$$

where l, m and n are parameters.

If at time $t = 0$, from equilibrium, there is a spontaneous change, Δv, in consumption, then

$$\frac{dw}{dt} = u - (v + \Delta v) = (l - m)\,p - \Delta v.$$

Also $$\frac{dp}{dw} = \frac{1}{n}.$$

Therefore $$\frac{dp}{dt} = \frac{dp}{dw} \cdot \frac{dw}{dt} = \frac{l-m}{n} \cdot p - \frac{\Delta v}{n}$$

or $$n\frac{dp}{dt} - (l - m)\,p + \Delta v = 0.$$

The solution of this equation,

$$p = \frac{\Delta v}{l-m}\left(1 - e^{\frac{l-m}{n} \cdot t}\right),$$

gives the path of the induced price change. The stability condition is that $\frac{l-m}{n} < 0$. If it is assumed that price falls as stocks increase, then $n < 0$ and the stability condition is that $l - m > 0$ or that $l > m$. In this case the price converges exponentially towards the equilibrium value $\frac{\Delta v}{l-m}$ as $t \rightarrow \infty$. If $l < m$ the system is explosive.

For a spontaneous change, Δu, in the production flow the induced price change is

$$p = -\frac{\Delta u}{l-m}\left(1 - e^{\frac{l-m}{n} \cdot t}\right).$$

And for a spontaneous change in the demand for stocks, causing an immediate change in price of Δp, the path of the subsequent induced price change is

$$p = -\Delta p\left(1 - e^{\frac{l-m}{n}\cdot t}\right),$$

i.e., the price returns to its original equilibrium value.

This simple model could be further developed, in particular by making a distinction between working and liquid stocks[1], introducing lags into the production and consumption functions[2], and linking the demand curve for liquid stocks to the rate of change of price through a co-efficient of expectations.[3] Each of these developments would result in an oscillatory system. They will not be considered further here, however ; the simple model has been described to show the main principles of the mechanism, which will now be applied to macroeconomic models.

II

1. Description of a Simple Model

In the model shown in Fig. 3, an economy without foreign trade or government operations is assumed. These simplifying assumptions will be relaxed later. The water in the bottom tank, M_1, represents active or transactions money balances, defined as the minimum working balances needed to carry on a given level of economic activity, and assumed to be a function of income.[4] Income, Y, flows from M_1 through a slot, shown in the inset in Fig. 3. The slot is of such a shape that the rate of flow through it is proportional to the height of water in the tank[5] ; the height can therefore be used to measure the income flow, on a linear scale. An

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[1] See J. M. Keynes, *Treatise on Money*, 1930, Ch. 29, also J. R. Hicks, *A Contribution to the Theory of the Trade Cycle*, 1950, pp. 47–55.

[2] In the form appropriate to a continuous analysis, i.e., the actual value approaches the value that would obtain if there were no lag at a rate which is a function of the difference between the actual and the unlagged values.

[3] As defined by Lloyd A. Metzler in "The Nature and Stability of Inventory Cycles", *Review of Economic Statistics*, 1941 ; but with slight changes to make the concept applicable to a continuous instead of a discontinuous model.

[4] This hypothesis has been used in a mathematical model by Richard M. Goodwin. See "Secular and Cyclical Aspects of the Multiplier and the Accelerator", *Essays in Honor of Alvin Hansen*, pp. 112–118. Expressed in a slightly different form, it is also made the basis of a model by Paul A. Samuelson : *Foundations of Economic Analysis*, pp. 276–280.

[5] The shape is given by the formula $W = c.\frac{1}{\sqrt{h}}$ where W is the width of the slot at any height h, and c is a constant depending on the viscosity of the liquid.

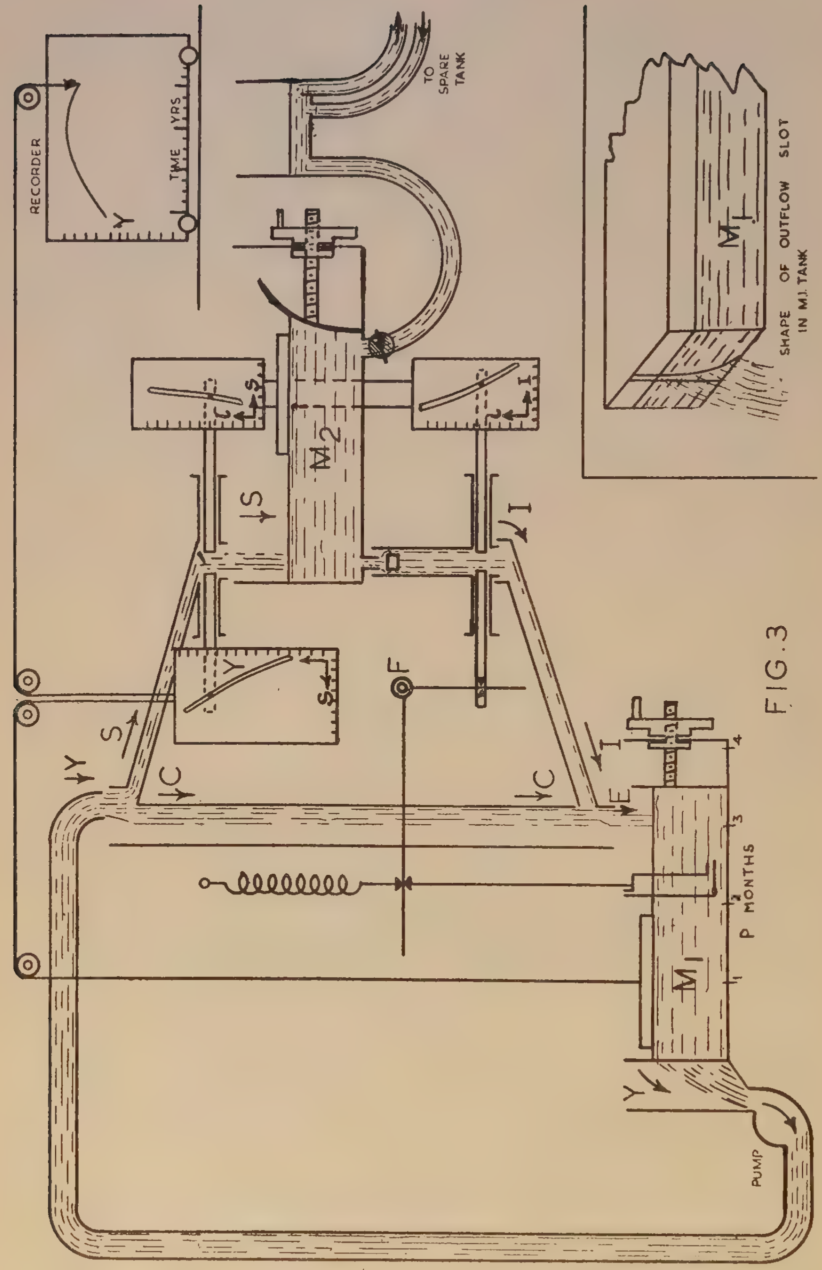
RECORDER
TIME
YRS
Y
TO SPARE TANK
S
I
M2
S
I
Y
S
F
S
Y
C
C
I
E
P MONTHS
1
2
3
4
M1
Y
PUMP
SHAPE OF OUTFLOW SLOT IN M.I. TANK
M1

FIG. 3

electric pump carries the income flow to the top of the model, where it divides into savings, S, and consumption, C.[1]

Savings are controlled by two opposed valves, and measured by the opening between them, consumption being left as a residual. (In a later model consumption is controlled and savings made the residual.) Consumption expenditure flows directly back into M_1. Savings flow into the tank containing idle or surplus balances, M_2, defined as all money in excess of minimum working balances. Investment expenditure, I, controlled and measured by two valves, is drawn from M_2 and, combining with consumption to form total expenditure, E, flows into M_1.

To allow for extension or contraction of the supply of money, water is pumped from a separate tank (not shown in the diagram) into the small box on the extreme right of the model, the overflow from the box returning to the tank. The box is connected by a flexible tube to the M_2 tank. The height of the box can be varied to make the level of water in it higher or lower than that in the M_2 tank, causing a flow to or from M_2 roughly proportional to the difference between the two levels. A tap in the tube can be closed when it is desired to operate with a constant quantity of money.

The time taken for the active balances to circulate once round the system, equal to $\frac{M_1}{Y}$, is the reciprocal of the income velocity of circulation of active balances and will be called the circulation period, P. The actual length of the circulation period seems to be somewhere between three and four months in England and the United States[2]. On the model, if the adjustable end of the M_1 tank is vertical, P will be proportional to the operative length of the tank irrespective of the value of Y, since both M_1 and Y are then proportional to the height of water in the tank. A linear scale may therefore be fitted along the tank, giving the circulating period in months. The position of this scale determines a time constant for the model. If, when the adjustable end of the tank is set at the mark three months on the scale, the time taken for the quantity of water in the tank to flow once round the circuit is half a minute, the time constant is two minutes on the model to one year in reality. A recorder may then be fitted to trace a chart of income against time in years.

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[1] The pump motor is fed through two electrodes partially immersed in the water over the inflow to the pump, providing automatic speed regulation of the pump and keeping the level of water in the inflow tube constant. Since the quantity of water in the outflow tube is also constant, the flow into C and S at the top of the model always equals Y.

[2] See F. Machlup, "Period Analysis and Multiplier Theory", *Quarterly Journal of Economics*, November, 1939.

When the system is in equilibrium $I = S$, $E = Y$, and the rate of change of M_1 and M_2 is zero. If, from this position there is an increase in investment and therefore in E, Y does not increase immediately by an equal amount, but only gradually as the excess of E over Y gradually increases M_1. This lag between expenditure and income (and their real counterparts sales and output) occurs because an increase in expenditure and sales at first leads chiefly to a reduction in stocks, and must be transmitted through complex chains of intermediate transactions, some short, others very long, before it produces an equivalent increase in output and income.[1] In the model, there is no lag between income and expenditure, i.e., no Robertsonian lag. If, however, we redefine Y to be identical with E, the inflow into M_1, and call the outflow from M_1 "disposable income", we no longer have a sales-output lag but have instead a distributed equivalent of the Robertsonian income-expenditure lag. The operation of the model is in no way affected by the choice between these sets of definitions, which lead to similar results providing the periods of the lags are the same. From empirical evidence[2] it seems that the income-expenditure lag is small in relation to the expenditure-income (or sales-output) lag, so the latter interpretation is used here.

There is, of course, no reason why a model including both lags should not be made. In the mechanical model this would require the inclusion of a small tank, the outflow from which would be proportional to the height of water in it, in the income flow. The inflow to this tank would be income, and the outflow would be the equivalent in continuous analysis terms of Robertsonian disposable income. Water in the first tank would represent business working balances and in the second would represent personal working balances. Business and personal savings would have to be treated separately, business savings being assumed to be a function of output (income), and personal savings a function of disposable income. It can be shown that a change in the system would then be made through a series of damped oscillations.[1]

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[1] The sales-output lag used by Lundberg in his dynamic sequence analysis is in some ways more realistic than the one used here. He relates the length of this lag to the "production-planning period", not to the circulation period of active balances, and also allows for attempts by producers to keep their stocks constant, or at a constant proportion of sales. Any change is then accompanied by a series of damped oscillations, as is shown by Lloyd A. Metzler in "The Nature and Stability of Inventory Cycles", *Review of Economic Statistics*, August, 1941. In the model described here the accelerator must be used to deal with the effects of changes in stocks, investment being interpreted to include expenditure by producers to maintain stocks. When total expenditure is rising and stocks are being depleted, there will be additional investment by producers attempting to maintain stocks, this additional induced investment being made a lagged function of the rate of change of income.

[2] See Lloyd A. Metzler: "Three Lags in the Circular Flow of Income", *Essays in Honor of Alvin H. Hansen*, pp. 11–32.

The relationship between the variables can be seen from the diagram. The shape and position of the curved end of the M_2 tank are derived from the liquidity preference function, so that the height of the water in the M_2 tank measures (inversely) the rate of interest, i. The rate of interest operates the "classical" savings curve and the marginal efficiency of capital curve to control savings and investment. Savings are also controlled through the left-hand valve by the propensity to save curve, which is operated by a float on the M_1 tank so that it moves vertically with income. A "propensity to invest" curve could be used similarly to operate the left-hand valve controlling investment; but it has been thought preferable to introduce an accelerator relationship between income and investment.[2] The accelerator mechanism consists of a narrow, deep float with a small hole in the bottom, hanging from a spring, and connected by a bent lever to the investment valve. In equilibrium the level of water inside the float will be the same as that in the M_1 tank, and the position of the valve is that of zero induced investment. If Y is decreasing, the level of M_1 will be falling and will be temporarily below the level of water in the float, since the water inside the float can leak out only slowly. Extra weight will be placed on the spring, which will extend, closing the investment valve a little, and so causing negative induced investment. Conversely, when Y is increasing induced investment will be positive, being always a lagged function of the rate of change of income.

It will be noticed that in this model $S = f(Y) + \phi(i)$, and similarly for investment, though a better assumption would be that $S = \psi(Y, i)$. The latter assumption could be used if the two savings valves were replaced by a single spring-loaded one, bearing against a block with surface contours given by $S=\psi(Y, i)$, the block moving vertically with income and horizontally, at right angles to the valve movement, with the rate of interest.

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[1] For a geometrical treatment of a similar model on the assumption that the two lags are equal, see a forthcoming article by Ralph Turvey and Dr. Hans Brems.

For an account of how the macroeconomic concepts can be further broken down to give complex systems of lags and functions see R. M. Goodwin: "The Multiplier as Matrix" *Economic Journal*, December, 1949.

[2] The model shown in Fig. 1 has a propensity to save and no accelerator.

In models of this type it is usual to assume either that the values are given in some kind of real units, or that they are in money units but that prices are constant. In the mechanical model we can, however, introduce prices indirectly into the system, though in a rough and cumbersome way, by making use of the fact that the machine will deal with non-linear relationships. The general price level is assumed to be a function of money income, Y. This function can be drawn on the side of the M_1 tank, with Y along the ordinate and the price level along the abscissa, the values being read off at the intersection of the curve and the level of the water. Another curve of real income against money income can also be drawn, derived from the price curve. Any relationship given in real units can then be converted into an equivalent relationship in money units, and the graph of the latter used on the machine.

2. THE MULTIPLIER WITH CONSTANT RATE OF INTEREST

In the mathematical treatment of the model the functions must be assumed to be linear and prices to be constant. If the rate of interest is held constant by appropriate variations in the supply of money, and the accelerator neglected so that investment is made an independent variable, we have the following identities by definition, the variables being measured, for simplicity, from a base at which the system is in equilibrium.

$$Y = C + S,$$

$$E = C + I,$$

$$\text{and } E - Y = \frac{dM_1}{dt}.$$

Therefore

$$I - S = \frac{dM_1}{dt} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (1)$$

The hypotheses are:

$$M_1 = PY, \text{ or } \frac{dM_1}{dt} = P\frac{dY}{dt}, \quad \ldots\ldots \quad (2)$$

$$\text{and } S = \sigma Y, \quad \ldots\ldots\ldots \quad (3)$$

where σ is the marginal propensity to save.

If, from equilibrium at time $t=0$, investment increases by $\triangle I$, then, from equations (1), (2) and (3),

$$P\frac{dY}{dt}+\sigma Y-\triangle I=0 \quad \ldots\ldots\ldots\ldots\ldots \quad (4)$$

The solution is

$$Y_t=\frac{\triangle I}{\sigma}\left(1-e^{-\frac{\sigma}{P}.t}\right), \quad \ldots\ldots\ldots\ldots \quad (5)$$

where t is time in years and P, the circulation period, is also given as a fraction of a year.

Also,

$$E_t=\frac{\triangle I}{\sigma}\left(1-e^{-\frac{\sigma}{P}.t}\right)+\triangle Ie^{-\frac{\sigma}{P}t}. \quad \ldots\ldots\ldots\ldots \quad (6)$$

Equations (5) and (6) give the same final value for the multiplier as is obtained in the usual period analysis, and the equilibrium values are approached along a similar path, though of course it is continuous instead of stepped. If the curves are drawn however, it will be found that the process of adjustment in this model is slower than that obtained in a period analysis model in which the lag is made equal to the circulation period. This results from the form of distributed lag used here. This lag, L, may be defined as the time interval by which Y lags behind E, i.e., the value of L which makes $Y_{t+L}=E_t$ for all values of t. For instance, if E increases by 100 units, it is the time which elapses before Y has also increased by 100 units. By substituting equations (5) and (6) in this expression, we obtain the relation

$$L=P\left[-\frac{\log_e(1-\sigma)}{\sigma}\right].$$[1]

Some values of L with different marginal propensities to save are worked out in the table below.

σ	L
0	P
.2	$1.12P$
.5	$1.39P$
.8	$2.01P$
1.0	∞

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[1] I am indebted to Mr. W. T. Newlyn and Mr. J. D. Sargan, of Leeds University, for pointing out this relation.

The speed of the adjustment process is determined not by the circulating period alone, but by the distributed lag L, which is longer than the circulating period except when the marginal propensity to save is zero. Though both the continuous analysis and the period anaylsis are only crude approximations to reality, I think there is no doubt that the continuous analysis is more realistic than one in which adjustments are assumed to occur in steps at intervals of three or four months. If this is so, it must be concluded that the time taken for a multiplier process to work itself out is longer than that shown by a period analysis sequence in which the lag is made equal to the circulation period of active balances.

3. THE MULTIPLIER WITH CONSTANT QUANTITY OF MONEY

If the quantity of money is constant, the rate of interest being free to vary, we must make use of the part of the mechanical model which deals with the determination of the rate of interest. It is obvious from Fig. 3, that in this case the multiplier process following a spontaneous increase in investment $\triangle I$ will be to some extent checked if the transfer of money from M_2 to M_1 induces a rise in the rate of interest, since this will reduce the excess of investment over savings (unless the curves are such that a rise in the rate of interest decreases savings more than it does investment, which is highly improbable).

Measuring the variables again from a base at which the system is in equilibrium, and assuming linearity, we have another identity,

$$M_2 = -M_1, \qquad (7)$$

and two additional hypotheses,

$$M_2 = \lambda i \qquad (8)$$

$$\text{and } I = \eta i, \qquad (9)$$

where λ is the liquidity preference function "proper" (Keynes's L_2 function) and η is the marginal efficiency of capital function. Equation (3) must also be changed to

$$S = \sigma \Upsilon + \xi i, \qquad (10)$$

where ξ is the slope of the interest-savings curve.

From (1), (9) and (10), and introducing the spontaneous change $\triangle I$, we obtain

$$\frac{dM_1}{dt} = \triangle I + (\eta - \xi)i - \sigma \Upsilon,$$

and substituting (2), (7) and (8) in this and rearranging gives

$$P\frac{dY}{dt}+\left[\sigma+\frac{P}{\lambda}(\eta-\xi)\right]Y-\Delta I=0 \;\ldots\ldots\; (11)$$

The solution is:

$$Y_t=\frac{\Delta I}{\sigma+\frac{P}{\lambda}(\eta-\xi)}\left[1-e^{-\left(\frac{\sigma}{P}+\frac{\eta-\xi}{\lambda}\right)t}\right], \;\ldots\ldots\; (12)$$

which gives the path of the multiplier process.

P is always > 0, and since we may be confident that $\lambda < 0$, $\eta < 0$ and $\xi > \eta$, we know that $\frac{\eta-\xi}{\lambda} \geqq 0$. Equation (12) therefore shows that when the quantity of money is constant the multiplier is smaller, and the process of adjustment more rapid, than when the rate of interest is constant. The stability condition, that $\frac{\sigma}{P}+\frac{\eta-\xi}{\lambda} > 0$, also shows that the system is more stable; a marginal propensity to consume of more than unity ($\sigma < 0$) does not necessarily make the system explosive. If the elasticity of the liquidity preference curve is infinite, $\frac{\eta-\xi}{\lambda} = 0$, and we have the Keynesian special case, in which equation (12) reduces to equation (5) to give the usual multiplier process and stability condition.

4. The Accelerator

In this model the hypothesis is made that induced investment depends on the rate of change of income. It is not necessary to assume that all investment is induced investment, but as the equations will show only variations from an equilibrium position the constant part of investment need not appear. The relationship between income and induced investment must be lagged in some way if the system is to be oscillatory. We therefore set up the following hypotheses:

$$\bar{I}=\beta\frac{dY}{dt}, \;\ldots\ldots\ldots\ldots\ldots\ldots\; (13)$$

where $\bar{I}$ is the value that induced investment would have if there were no lag, and β is the acceleration co-efficient, and

$$\gamma\frac{dI}{dt}=\bar{I}-I, \;\ldots\ldots\ldots\ldots\ldots\ldots (14)$$

where γ is a lag constant. In words, induced investment approaches the value it would have if there were no lag at a rate proportional to the difference between the actual and the unlagged values.

Referring to Fig. 3, for a given construction of float and valve mechanism, β will be increased if the bent lever is raised, by raising both the fulcrum F and the point of attachment to the cord carrying the float, since this will increase the valve movement for a given extension of the spring. The lag constant will be increased by decreasing the size of the leakage hole in the float. This will also alter β, however, so the position of the lever must be adjusted whenever the lag constant is changed, if β is to be kept constant.

If it is assumed again that the rate of interest is held constant, we obtain by combining equations (13) and (14),

$$\frac{dI}{dt}=\frac{\beta}{\gamma}\cdot\frac{dY}{dt}-\frac{I}{\gamma}.$$

Combining equations (1), (2) and (3) gives

$$I=P\frac{dY}{dt}+\sigma Y,$$

and, differentiating with respect to time,

$$\frac{dI}{dt}=P\frac{d^2Y}{dt^2}+\sigma\frac{dY}{dt}.$$

Substituting these expressions in the previous one, and rearranging, we obtain

$$\gamma P\frac{d^2Y}{dt^2}+(\gamma\sigma+P-\beta)\frac{dY}{dt}+\sigma Y=0\;\ldots\ldots\ldots(15)$$

for the homogeneous part of the accelerator-multiplier equation. The roots of the characteristic equation become complex when

$$(\gamma\sigma+P-\beta)^2<4\gamma P\sigma,$$

and the system then becomes oscillatory.[1]

The accelerator will, of course, give different results if the rate of interest is allowed to vary; but there is not space to develop them here.

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[1] The accelerator used here thus gives results identical with those obtained from a mathematical model by Richard M. Goodwin: "Secular and Cyclical aspects of the Multiplier and the Accelerator", *Essays in Honor of Alvin Hansen*, pp. 118–124.

5. The Determination of the Rate of Interest

Discussions about the rate of interest seem often to have suffered through lack of a suitable technique for showing the process of change through time of the inter-related factors. The model described here may help to make it clear that the liquidity preference and loanable funds theories are neither inconsistent with each other, as might be thought from some of the controversies between their exponents, nor merely different ways of saying the same thing, as is sometimes implied,[1] but are complementary parts of a wider system.

Referring to Fig. 3, we see that in the model the rate of interest is determined at any instant only by the supply of and demand for " stocks " of idle balances. A decrease in liquidity preference " proper ", or an increase in M_2 if the liquidity preference curve is not infinitely elastic, will cause an immediate fall in the rate of interest. But if S and I are at all interest-elastic they will be changed both directly by the change in the rate of interest, and indirectly by the subsequent change in income, working through the propensity to save and the income-investment relation. Any difference between S and I causes a gradual change in M_2 and so reacts back on the rate of interest, so that the full effects of the change depend on the shapes of the " flow " functions.

We may assume that owing to the initial fall in the rate of interest I will increase, while S may decrease and in any case will not increase as much as I. The resulting excess of I over S causes a gradual fall in M_2, so that the rate of interest tends to rise again; but it also causes a gradual rise in M_1 and Y. If, as Y increases, it induces a greater increase in S than in I, this tendency will be checked before the rate of interest has returned to its original value. If, however, owing to the effect of the accelerator, or to a spread of optimism leading to a shift in the schedule of the marginal efficiency of capital, the increase in Y causes a greater increase in I than in S, the process of expansion will go further, and the rate of interest may temporarily rise above its original value. On the other hand, the rise in Y may also cause a further decrease in liquidity preference, so checking the rise in the rate of interest and enabling the expansionary process to continue even longer.

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[1] See J. R. Hicks: *Value and Capital*, 2nd edition, 1946, pp. 153–162.

Differences of opinion concerning the main determinants of the rate of interest, and the effects of a change in the rate of interest, thus depend on different assumptions made as to the shapes and stability of the relations involved, and it would seem more useful to attempt the difficult task of testing these relations empirically than to engage in arguments based on assumptions about them. However, one argument may be suggested here. If the liquidity preference curve is not infinitely elastic, and if a change in the rate of interest does not directly change savings in the same direction as, and by an equal or greater amount than, it changes investment, then the rate of interest has an equilibrating function in the system. Its effect is weaker and slower in action than was thought before the work of Keynes, and, moreover, in times of wide fluctuations in income it may be almost completely swamped by the effects of the accelerator and shifts in the liquidity preference and marginal efficiency of capital functions. But if sudden changes in the level of income are avoided by fiscal or other policies, the equilibrating influence of the rate of interest becomes relatively stronger, so that monetary policy becomes a necessary supplement to fiscal policy.

The paths followed by income and the rate of interest after initial changes in the system can be worked out mathematically. For instance, if from equilibrium at time $t = 0$, M_2 is increased by $\triangle M_2$, the path of the change in the rate of interest (neglecting the accelerator) is given by:

$$i_t = \triangle M_2 \left\{ \frac{1}{\lambda} - \frac{\eta - \xi}{\sigma P + \lambda(\eta - \xi)} \left[1 - e^{-\left(\frac{\sigma}{P} + \frac{\eta - \xi}{\lambda}\right)t} \right] \right\},$$

and the path of the change in income is given by

$$Y_t = \triangle M_2 \left\{ \frac{\eta - \xi}{\sigma\lambda + P(\eta - \xi)} \left[1 - e^{-\left(\frac{\sigma}{P} + \frac{\eta - \xi}{\lambda}\right)t} \right] \right\}.$$

The final effect on the rate of interest is therefore greater when $|\lambda|$ is small, $|\eta - \xi|$ is small and σ is large, while the final effect on income is greater when $|\lambda|$ is small, $|\eta - \xi|$ is large and σ is small. As in the case of the multiplier-accelerator process, such exercises have their uses, providing the limitations imposed by the assumptions are kept in mind.

Similar processes could be worked out on the mechanical model if the rate of interest were recorded. Non-linear relations could be used, and the effects of superposing shifts in different functions at different times could be observed, giving a sort of simplified picture of consecutive events in economic history.

III

So far we have assumed a closed economy with no government operations. In the model shown in Fig. 4, these assumptions are relaxed.[1] The income flow, after being pumped to the top of the model, divides into taxation, T, and income after taxation. The taxation flow is controlled and measured by a valve operated from the float on the M_1 tank through an income-taxation curve. Income after taxation flows into a small measuring box, the outflow slot of which is identical with that of the M_1 tank, so that the flow is measured by the height of liquid in the box, on the same scale as the measurement of income. The box is small so the error caused by water being trapped in it is negligible[2]. After flowing through the measuring box, income after taxation divides into consumption and savings, consumption being controlled by a propensity to consume curve and an interest-rate-consumption curve, savings being a residual.

The position of the consumption function is controlled by the level of water in the measuring box. As this box is too small for a float-operated control to work satisfactorily, it is necessary to use a small servo-motor mechanism. This consists of an electric motor driving the pulley over which the connecting thread passes. The speed and direction of the motor are controlled by two small electrodes partially immersed in the water. When the level rises, the motor turns the pulley in an anti-clockwise direction, lifting the electrodes and so maintaining their position relative to the water level. Conversely, when the level of the water falls, the motor turns the pulley in a clockwise direction. The operation is therefore similar to that which would occur if the electrodes were a float large enough to operate the consumption function directly.

The servo-mechanism also makes it possible to lag consumption behind income after taxation. The electrodes are immersed in the water in a small tube connected to the

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[1] This model is basically similar to that shown in the photograph in Fig. 1, but includes a number of improvements.

[2] This box could be made larger, and the liquid in it interpreted as personal working balances, so introducing a Robertsonian lag into the model.

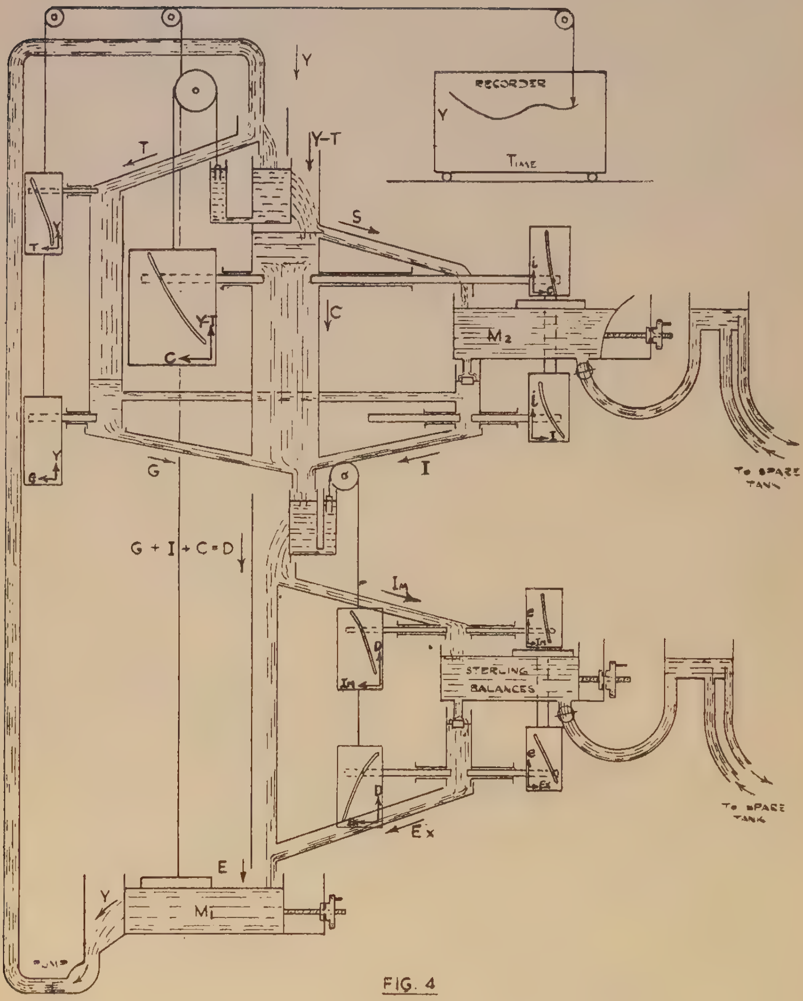
Y
RECORDER
Y
TIME
Y–T
T
S
C
Y–T
C
T
Y
M₂
i
C
i
I
TO SPARE TANK
G
I
Y
G
G + I + C = D
Im
e
Im
D
Im
STERLING BALANCES
e
Ex
D
Ex
Ex
TO SPARE TANK
E
M₁
Y
PUMP

FIG. 4

measuring box, not in the box itself. The size of the hole connecting the tube to the box is adjustable, and when it is small the level in the tube lags behind that in the box, so that the consumption flow becomes a lagged function of income after taxation. A distinction may be made between this type of lag and that which occurs in, say, the Robertsonian model. In the latter, the lag occurs as a result of a time interval between income and expenditure. This might be called a " structural " lag, and is represented in a continuous analysis by the time taken, after an increase in income, to build up working balances to a level commensurate with the higher expenditure. The type of lag just introduced acts in addition to the " structural " lag ; it might be called a " psychological " lag, caused by inertia in the changing of habits.

Government expenditure, G, is controlled and measured by a valve, which may also be operated as a function of income if it is desired to illustrate the stabilising effects of an automatic compensatory fiscal programme. The level of water over this valve is kept constant by connecting it through the horizontal tube to the investment tube. This also causes any budget deficit to be met automatically by drawing from idle balances, M_2, and any budget surplus to contribute to investment expenditure, the drain on idle balances being diminished by an equivalent amount.

Consumption, investment, and government expenditure combine to form domestic expenditure, D. Expenditure abroad for imports, Im, is taken from domestic expenditure, and receipts from abroad for exports, Ex, are added to give total expenditure on the goods of the home country, E, which flows back to the M_1 tank. Domestic expenditure is measured by taking it through a small box similar to that described above, and a second servo-motor mechanism operates a propensity to import curve, making imports a function (lagged if desired) of domestic expenditure.[1]

Payments for imports flow into, and receipts from exports flow from, the small tank marked " sterling balances ", the water in which represents foreign holdings of the money of the home country.[2] The quantity of these balances, together with the demand schedule for them, represented by the capacity of the tank at different levels, determine at any instant the rate of exchange, in the same way as in the case of price and of the rate of interest. This demand schedule might appropriately be called the sterling preference function.

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[1] For the use of this relationship in the analysis of the multiplier effects of international trade see J. E. Meade : " National Income, National Expenditure and the Balance of Payments ", *Economic Journal*, December, 1948, and March, 1949.

[2] There is probably some error involved in separating these balances from idle balances, since some part of them may be related to the rate of interest.

The rate of exchange is thus represented by the level of liquid in the tank, and a float can be used to operate exchange-rate-imports and exchange-rate-exports graphs controlling imports and exports through the right-hand pair of valves. A small box, fed from a spare water tank and connected to the sterling balances tank by a flexible tube, can be used to represent the operations of an exchange equalisation account, putting funds on to, or taking them from, the foreign exchange market in order to control the rate of exchange. When the tap in the tube is turned off, a system with freely fluctuating exchange rates is represented.

National income is recorded as in the previous model, and in the version which is now being constructed small measuring boxes and floats are being inserted in the imports and exports flows, enabling imports and exports to be recorded on a single chart, so that the trade balance will be seen directly from the gap between them. Assuming there are no other items in the balance of payments, it will then be possible to demonstrate the operation of the gold standard by adjusting credit expansion or contraction to a multiple of the trade balance at any time.[1]

It seems possible that these small boxes, included in this model admittedly for a purely mechanical purpose, may have some economic significance. For instance, those in the imports and exports flows, which will contain a volume of water proportional to the arithmetic average of imports and exports, might be interpreted as containing working balances necessary for financing actual foreign trade transactions, the sterling balances tank containing balances surplus to those required for current transactions. Similarly a box inserted in the investment flow would contain what might be called investment working balances, a circulating fund covering the time interval between money being taken off the money market and its actual expenditure on investment goods. This would seem to be the equivalent of Keynes's

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[1] I am indebted to Professor J. E. Meade for suggesting this device, as well as a number of others described in this section.

" Finance " balances. The additional relationships introduced into the system by such a division of working balances would considerably complicate the mathematical analysis in any particular case, though it can easily be shown that they would result in adjustments taking place through a series of oscillations.

It is possible to connect together two of the models shown in Fig. 4, to deal with the multiplier relationships between the incomes of two countries, or of one country and the rest of the world. To connect more than two would be difficult, since each country would have to have a propensity to import function for each other country. The easiest method of interconnection would be to assume a fixed rate of exchange, and run the imports flow of one model into the exports tube of the other. Another though rather more difficult way would be to use a servo-mechanism to operate the left-hand exports valve of each model, keeping exports always equal to imports on the other model multiplied by the rate of exchange, which could be held stable by the " equalisation account " operations.

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The European Payments Union

By R. F. KAHN

The precise details of the European Payments Union have not been fully disclosed at the time when this note has to go to press, and one gathers that some points still have to be settled. But sufficient can be gathered from the newspapers to justify a comparison of the proposed Union, which I will refer to as the E.P.U., with the scheme which I outlined in a recent number of *Economica*[1] and which I will refer to as the Discount Scheme. My main reason for rushing into print a second time, before the facts about the E.P.U. are altogether clear, is that I believe that the E.P.U. contains certain fundamental defects which can be illustrated by contrasting the principles on which it is based with those of the Discount Scheme. I feel that it may be worth while drawing attention to these general points straight away without the delay which would be involved in awaiting publication of the E.P.U. in its final form.

I do not attempt in this note to deal with the special difficulties about the position of sterling. Most of these would arise equally under the Discount Scheme. In any case, they do not readily lend themselves to discussion in purely economic terms.

The essence of the Discount Scheme is that at regular intervals the balances of each participant with the other participants taken together (which must add up algebraically to zero) would be settled by transfers of dollars (or gold), after they had been reduced in value by the amount of the " European Discount ", which could be altered from time to time. This settlement would be definitive—the liquidation in dollars, on the basis of the Discount, would completely discharge the outstanding credit and debit balances.

Under the E.P.U. the members will extend lines of credit to the Union and have lines of credit extended to them by the Union. The extent to which these credits are to be utilised is determined by the accrued credit or debit balance of each member with the other members taken together, reckoned cumulatively from the date at which the E.P.U. begins to function. The first *tranche* of credit or debit balances will carry with it no payment in gold. Of the subsequent *tranches* of credit balances, it appears that 50 per cent. will be settled by the Union in gold as they accrue to a member. A member which has a growing debit balance with the Union will have to settle in gold 20, 40, 60 and 80 per cent. of each successive *tranche*. It appears that an accrued debit balance which outstrips all the *tranches* will, if it grows any bigger, involve 100 per cent. gold payments to the Union, but that no decision has been reached about the position of credit balances beyond the point at which all the *tranches* have been exhausted.

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[1] " A Possible Intra-European Payments Scheme," *Economica*, November, 1949, pp. 293–304.

My main quarrel with the E.P.U. arises from the concept of " creditor " and of " debtor " countries. A " creditor " country is a country which has a favourable balance of payments *with the other members*, even though its *over-all* balance is adverse. A " debtor " country has an unfavourable balance with other members, but might conceivably have an over-all favourable balance. The philosophy of the E.P.U. is based on the view that there is something wrong—in the sense of departure from equilibrium—in a country being either in a " creditor " or in a " debtor " position with the rest of Western Europe. The latitude which the Union will provide in either direction is represented by an aggregate lump sum, the amount of which is fixed irrespective of the period of time over which the Union has operated. If this ceiling had been conceded as an annual rate, the amounts of the possible credits and debits being renewed year by year, much of my objection would have disappeared, since a " departure from equilibrium " in the E.P.U. sense could then be financed under conditions which could remain steady through time. But the ceiling is a cumulative aggregate and not an annual rate. Once the ceiling has been reached the Union can offer no further help however much time is allowed to elapse. For this reason alone its days are probably numbered, but that is a poor consolation for the unsuitability of the arrangements, particularly as the dimensions of the maximum credits and debits are generous, thus rendering it probable that the Union will run for two or three years before revision becomes essential.

The idea that " equilibrium " requires that each participating country shall balance its trade with the other participants taken together, irrespective of its trade balance with non-participants, had already crept into *Certain Principles of Commercial Policy*, recommended by the Council of O.E.E.C. in October, 1948.[1] This line of thought is adhered to in the *Second Report of the O.E.E.C.* (February, 1950), in which the basis of the E.P.U. was outlined : " the system must discourage " debtors (i.e., countries which have a deficit with the other participants) " from incurring excessive deficits. It must also provide some safeguard for the creditors that they will not have to give unlimited credit . . . , while at the same time discouraging them from incurring excessive surpluses within the group " (p. 229).

Under the Discount Scheme it would be a matter not of " creditors " and of " debtors ", but of credit and debit balances, taking their origin in a restricted field, which would periodically be settled in dollars (or gold), after they had been reduced by the application of the European Discount. A country could continue year after year under the Discount Scheme with a negative balance with the other participants so long as it could find the dollars required to settle it, and a country could continue with a positive balance so long as it was prepared to accept the operation of the European Discount. The Discount Scheme provides for offsetting operations and not for borrowing and lending.

In this way it would promote triangular trade even though one apex of the triangle lay outside Europe. The E.P.U., on the other hand, will facilitate triangular trade only in so far as all three apices lie inside Europe. It is inconsistent with the philosophy of the E.P.U. that, say, Belgium should permanently enjoy a favourable balance of trade with the other participants offset by an unfavourable balance with America. It seems to be contemplated that the persistence of such a state of affairs would eventually necessitate Belgian trade taking place under gold-standard conditions, Belgium's favourable balance with Europe being paid eventually 100 per cent. in gold (though this, as I say, is a decision which appears to have been left to the future to deal with—one reason why a fairly early collapse of the Union can be predicted).

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[1] Cf., *ibid.*, p. 294n.

It is more difficult to suggest an example of the opposite kind, i.e., of a country which may be a " debtor " in the European context but may achieve over-all balance of payments equilibrium by having a favourable balance of payments with America. This very fact illustrates the main issue. In my previous article I stated that the Discount Scheme was " not intended to finance an over-all balance of payments deficit " ; " the countries which run into debt on the European clearing must secure sufficient net dollar receipts from their trading and financial relations with other parts of the world to clear their European debits."[1] The E.P.U., on the other hand, seems to be mainly designed to secure some once-and-for-all help from some countries for the benefit of other countries. It so happens that, by and large, the countries which have a trading surplus with the other participants are the countries which, despite deficits in other directions, enjoy a relatively strong over-all balance of payments, while, on the whole, it is the countries with the large European deficits which are in the weaker over-all position. This natural correlation is reinforced by the fact that the allocation of Marshall Aid is to a considerable extent based on dollar deficits rather than over-all deficits. The E.P.U. will thus carry on the " little Marshall Plan ", the credits which it provides being on this occasion once-and-for-all rather than annual. That some European countries should thus be called upon to help others which badly need help is in one sense an admirable thing, but this objective is different from that of a payments scheme properly conceived.

The same confusion underlies the concept of " structural creditors ", who, perhaps, should be discriminated against, and " structural debtors ", who, perhaps, should enjoy discrimination in their favour. Trade discrimination is an important means (provided that it is not used as an excuse for maintaining an undesirable rigidity of exchange rates) of moulding the pattern of trade so as to involve the minimum of strain, but it is the over-all position to which it must be directed and not merely the balance within a particular section of the map, if triangular trade of a desirable kind is not to be flattened out of existence.

In postulating that under the Discount Scheme a country which was a " European debtor " must be deemed to be in over-all balance, meeting its European deficit out of a surplus earned elsewhere, I included Marshall Aid as a contribution towards such a surplus. And I should also, of course, include any subsequent form of help from the United States. Let us suppose, for example, that President Truman's Point Four became a source of substantial dollar aid to some parts of the sterling area. This might enable the sterling area, represented by the United Kingdom, to finance a continuing deficit with the rest of Western Europe, which would in this way earn some of the Point Four dollars. But under the rules governing the E.P.U. such a deficit would before long have to be financed 100 per cent. in gold, and full gold-standard conditions would then govern the policy of the sterling area in its trading relations with the rest of Western Europe (this issue, unlike the similar issue arising with persistent European creditors, appears to have been definitely settled in favour of 100 per cent. gold payments); whereas under the Discount Scheme the European Discount, so long as it remained in operation, would continue to provide the sterling area with an incentive to buy in Europe and to sell elsewhere.

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[1] *Ibid.*, p. 297n.

One doubts, in the light of such considerations, whether the E.P.U. is seriously intended to survive the end of Marshall Aid on the 30th June, 1952. It is true that we have no right to assume that during the period in question every participating country will fall decisively into one or other of the categories of " European creditor " and " European debtor ". For a country which preserves, over a course of years, taken together, a fairly balanced trade with the rest of Western Europe, the E.P.U. will serve a useful purpose by helping to finance the temporary " swings " of the trade balance. This is a helpful contribution, but the greater the number of countries which fit into the category, the greater is the danger, referred to under (2) below, that the operations of the E.P.U. will serve in some quarters to give an unduly inflationary stimulus to intra-European trade, with adverse effects on European dollar earnings.

Other advantages of the Discount Scheme, and disadvantages of the E.P.U., may be summarised as follows :—

(1) The extent to which the E.P.U. will, through its operations, encourage countries to buy inside Western Europe and sell outside will vary a great deal between one country and another. The point here is that an

addition to a country's imports from other participants, or a reduction of its exports to other participants, involves no loss of gold so long as the country's cumulative credit or debit with the Union has not exhausted the first *tranche*, but beyond that point it has to be paid partly in gold on a progressive scale. It is perhaps desirable that if the incentive to discriminate in favour of imports from other participants operates unevenly, a country which has conceded on its import restrictions more than it has received should on that account be subjected to a diminished incentive. This the operation of the E.P.U. will secure. But it will also secure—and clearly this is *not* desirable—that the incentive shall also diminish simply because a country's response to it has been inadequate. Belgium may once again be running a favourable balance with the rest of Western Europe. That is *not* a reason why there should be a *diminution* in the incentive to Belgium to discriminate in favour of imports from Europe and in favour of exports to countries outside Europe. And yet that is what is going to happen. Under the Discount Scheme, on the other hand, the incentive to buy in Europe and to sell outside Europe would at all times apply equally to all participants.

(2) Actually it will be worse. Many countries (including perhaps Belgium) will realise from the outset that before the Union is wound up they will have exhausted the credits, or the debits, provided under the E.P.U. A "debtor" country which is in this way faced with the certainty of having ultimately to make 100 per cent. gold payments is in effect on the gold standard *from the start*. All that the E.P.U. provides to it is a once-for-all loan (equal to 60 per cent. of its "quota"), and, after that has been taken into account, *all* its imports from Western Europe will have effectively cost it 100 per cent. in gold *at all stages*, and, similarly, all its exports to Western Europe represent to it at all stages 100 per cent. in gold. The fact that the loan is not paid over all at once, but only as and when the successive *tranches* are exhausted, is immaterial (apart from the question of interest). A country faced with the certainty of having eventually to make 100 per cent. gold payments will behave as though it had to do so at the start. There will be no incentive to discriminate

in favour of imports from Western Europe and in favour of dollar exports, and if it is in balance of payments difficulties it will be as anxious to cut down on its imports from Western Europe as on its dollar imports. The position is less clear for a " creditor " country which is faced with the certainty of outstripping the latitude provided by the Union, because here (apparently) a decision has not yet been reached. In so far as it expects on completing the final *tranche* to be able to enforce 100 per cent. gold payments it will behave as though it was on the gold standard from the start. Doubts about its ability to do so will exert a moderating influence, but in any case a prospective persistent " creditor ", like a prospective persistent " debtor ", will from the start be less anxious to import from other participants than a country which expects its cumulative position with the Union to lie within the limits of the first *tranche* in either direction. And while some countries—the persistent " creditors " and the persistent " debtors "—will be subject to an unduly small incentive to be liberal in admitting imports from Western Europe, countries which, at worst, expect to lose only a small amount of gold to the Union over its lifetime, are likely to be tempted to be unduly profligate in deciding about imports from Western Europe, thus increasing the inflationary pressure in the supplying countries and perhaps diminishing Europe's dollar-earning exports.[1] It is only as a matter of pure chance, and then only over a limited period of time, that the operations of the E.P.U. will, in their somewhat arbitrary incidence on a particular member, afford just the right incentive, neither too great nor too small, to discriminate in favour of imports from other members and in favour of exports to non-members.

(3) Some countries may find themselves drifting in the extreme " creditor ", or in the extreme " debtor ", position without having been certain from the start that they would do so. With the passage of time their trade policies will gradually be more and more dominated by gold-standard conditions.

(4) Under the Discount Scheme, on the other hand, the European Discount could be altered from time to

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[1] Cf., *ibid.*, p. 299 under (*g*).

time so as to take account in a deliberate, and not in an arbitrary, manner of any change in the underlying conditions. If (despite any reduction in the amount of United States aid) the dollar difficulties of Western Europe were progressively reduced (thanks no doubt partly to the maintenance of discriminatory practices), the European Discount could, and should, be lowered from time to time. When it had been lowered to zero full convertibility would have been restored. In this way the Discount Scheme would provide a gradual and natural transition to full convertibility. It is not clear how the E.P.U. can do any such thing.

(5) Under the Discount Scheme the dollar (or gold) payments made at the settlement in respect of any period of time must exactly balance out. It would therefore function independently of Marshall Aid. In the case of E.P.U. there is no reason why there should be an exact balance. The credit *tranches* are, after the first, all payable as to 50 per cent. in gold, while this ratio is reached (and it is then exceeded) for debtor countries only after the first three *tranches*. That is why the Union has to be financed by the United States, so as to cover the prospective excess of gold payments to "creditors" over gold receipts from "debtors". But the amount of such excess cannot be predicted with any certainty. It will depend on the degree of skewness of the pattern in which countries become grouped as between "creditors" and "debtors", and as between small "debtors" and heavy "debtors". If the initial dollar endowment of the Union has been calculated to meet all conceivable contingencies, it can only mean a high probability that some potential Marshall Aid, which might otherwise have gone direct to some of the participants, will have been irretrievably abortive, the Appropriation of Congress being incompletely utilised.

(6) Under the Discount Scheme the periodic settlement would be definitive, leaving no residual balances behind it. Under the operation of the E.P.U. all the usual doubts will arise as to the value of credit balances and the oppressiveness of debit balances. Much will turn on the conditions for liquidation, but even when

these are known a good deal is likely to be left to conjecture and speculation. As I said in my previous article, " European trade policy would be paralysed by much the same doubts and uncertainties as afflict it at present ".[1] The charging, and perhaps the granting, by the Union of an appreciable rate of interest (as to which a decision appears still to be outstanding) would render the position more definite, but only in an unfavourable sense.

(7) A further element of doubt and hesitation will be introduced by uncertainty as to the length of life of the Union. Under the Discount Scheme each settlement period would be a separate entity, the nature of the settlement having no effect on future operations.

One element in the Discount Scheme which may have created objection is the complete writing off of the proportion of a credit balance represented by the European Discount, but to prefer the E.P.U. on that account is to accept with unjustifiable credulity the face value of a credit with the Union, the break-up value of the assets of which (consisting, as they will, of the weaker European currencies) must be regarded with caution. Let us compare the position under the Discount Scheme with the same position (i.e., the same pattern of trade) under conditions of full convertibility. It is true that under the Discount Scheme the sums written off would have to be found for the Central Bank from the Exchequer.[2] If the country's fiscal policy was aimed at stability the effect would be an increase in the National Debt (since the necessary funds would have to be secured by borrowing if deflation was not to result), but this would be balanced by an increase in the securities held by the Central Bank (which to the extent of the writing off would hold securities instead of gold) ; the interest paid out on the increase in the National Debt would be balanced by the additional interest earned by the Central Bank, and indeed all that would have to be done would be to issue additional Government securities to the Central Bank.

This does not of course mean that the operation of the European Discount would involve no loss to such a country, the comparison again being with conditions of full convertibility. The loss would take the form of the reduction in the amount of imports from dollar countries which the favourable balance of trade with the other participants would finance. But this loss would be apparent rather than real, in so far as full convertibility was not a practicable alternative (or in so far as, if introduced, it would result in a reduction of the country's favourable balance with the other participants).

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[1] *Ibid.*, p. 297n.

[2] *Ibid.*, p. 300.

My previous article was written just before the devaluation of last September. I hazarded the guess that a European Discount " of rather less than 50 per cent. would work out about right ",[1] and I said that " as and when devaluation took place, the proper value of the European Discount would be reduced by the average amount of the devaluation ".[2] If I now (June, 1950) had to make another guess, in the light of devaluation and the passage of time, I should put it at rather more than 25 per cent., but I should expect, and hope, that as the fruits of devaluation mature, a fairly rapid further reduction would be called for (provided that current optimism about the rapid disappearance of the " dollar shortage " did not result in the partial abandonment of the discrimination against dollar goods which in considerable measure is responsible for the apparent alleviation of the dollar shortage). In the making of any comparison between a conjecture of the desirable size of the European Discount and the actual proportions of gold payments which will have to be made for successive E.P.U. *tranches*, it must be borne in mind that the residual balances (represented by the European Discount) under the Discount Scheme are written off at intervals while under the E.P.U. the residual balances remain as assets and liabilities which will not be entirely ignored.

Devaluation has improved the position in another way. It has been very far from uniform. In particular, the difficulties caused by Belgium's competitive position, to which I made several references in my previous article, have been reduced. As I then said, " fundamentally, of course, it is a matter of an adjustment of the Anglo-Belgian rate of exchange, which will no doubt come in time ".[3] It has, but if Belgium was to cease altogether to act as a source of disturbance to the Western European pattern of trade, she would have to take her share of discriminatory restrictions against imports of dollar goods, thus improving her own market for the products of other participants and reducing still further her credit balance with them. If the E.P.U. works out in accordance with the above prediction Belgium will be under little inducement to do this.

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[1] *Ibid.*, p. 297. [2] *Ibid.*, p. 300. [3] *Ibid.*, p. 302.

One word in conclusion. The tone of this note is grudging and it may appear that I am inadequately appreciative of the efforts of those who have laboured in Paris, and elsewhere, to secure the establishment of the E.P.U. If I begrudge the adoption of a scheme other than the Discount Scheme, it does not mean that I fail to recognise that the E.P.U. marks an enormous improvement on the Intra-European Payments Agreements for 1948–49 and 1949–50, which themselves, with all their defects, were much better than nothing at all. The introduction at last of convertibility inside Western Europe will prove a most important achievement. My main doubt is whether its introduction through the E.P.U. will not provoke many of the difficulties which would face the introduction of full dollar convertibility.

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On a Theory of the Trade Cycle[1]

By A. D. Knox

I

Economists already owe much to Dr. Hicks for his many penetrating analyses. It is not surprising therefore that he has provided us, in a short and most readable book, with a highly stimulating theory of the business cycle. Readers of *Economica* will already be familiar with the elements of this theory,[2] but to help our discussion of it we may begin with a brief summary.

The boom is generated by the accelerator and the multiplier; but it can continue only until the attainment of full employment restricts the rate of growth of output. This retardation acts through the accelerator to diminish the output of investment goods and thence that of the economy. Gradually in the ensuing downswing the part of investment that is induced through the acceleration principle ceases, leaving only investment that is independent of the fluctuations of output and is assumed to grow at a constant rate. Influenced by this autonomous investment and by the multiplier, output asymptotically approaches an equilibrium that rises at a rate equal to that of autonomous investment. The accelerator is revived by the absorption of idle capacity, and the upswing of a new cycle begins.

II

In his opening chapter Hicks decided to express his theory in terms of output and not of employment, and to rely heavily on the acceleration principle, which in its traditional form relates real investment to real output. He therefore expresses his multiplier not in Keynesian wage-units but in real terms. It is doubtful if many tears will be shed over this rejection of wage-units, especially as this Keynesian concept has played little part in recent discussions of the multiplier and the consumption function. We may, however, have some qualms over the use of a purely real consumption function, and we may wonder whether we are entirely justified in assuming that in an economy so dependent on monetary relationships as ours the distorting influence of " money illusion " is never present. But this is the price we must pay if we are to follow Hicks and banish money until the closing chapters of the book.

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[1] J. R. Hicks, *A Contribution to the Theory of the Trade Cycle* (Oxford, 1950).

[2] J. R. Hicks, " Mr. Harrod's Dynamic Theory ", *Economica*, May, 1949.

The rejection of wage-units, however, is not the major burden of Hicks' chapters on the multiplier. His principle concern is with the effects of lags on the process of adjustment involved in the multiplier theory. He illustrates these effects with a lucid diagrammatic restatement of the Kahn convergent process, dealing with a single increase of investment to a new and constant level. His conclusion, in which we may concur, is that " however we vary our assumption about lags—however complex we make them—we shall always get a process of the Kahn type, converging faster or slower according as more or less consumption is lagged, and according as the average length of lag is greater or smaller ".[1]

Having presented this generalisation of the multiplier and made us familiar with his method of analysis, Hicks is now ready for sterner stuff ; and it is quite safe to say that his development of the multiplier analysis merits the closest attention by virtue both of its content and of its clarity. Starting with the case of investment that is expanding at a constant arithmetical rate, he shows that the course traced out by national income will slowly approach a moving equilibrium parallel to the regression line that represents the savings function. From this there follows a further development : where investment is rising at a constant geometric rate national income will asymptotically approach a moving equilibrium that rises as fast as investment. We thus have the multiplier element in Hicks' explanation of the upswing.

Hicks ends his analysis of the multiplier by drawing two conclusions. The first stresses that the multiplier with lags tends to have a damping effect on the cycle—a conclusion useful in explaining the comparative stability of the consumers' goods industries. The second is a restatement of the seldom remembered difficulty of computing the aggregate consumption function, and its *alter ego* the multiplier, in an unstable economy. Indeed the consumption function used by Hicks is essentially the long-run type investigated by Kuznets[1], and not the more vulnerable short-run function computed from data for the inter-war years. Hicks' plea of nescience in these matters is justifiable[2]; but at the same time we must note an element in his theory which may cause difficulties. Hicks has to invoke a monetary factor to provide a realistically drastic downswing. If we accept the Modigliani[3]—Duesenberry[4] hypothesis of an asymmetrical consumption function, the downswing in Hicks' real theory would be made even slower than it is at present and his reliance on the monetary factor consequently greater.

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[1] *Trade Cycle*, p. 21.

There is one point in this exposition of the multiplier which calls for comment. We are shown a skilful technique for handling lags, but one cannot quite escape the feeling—both in these chapters on the multiplier and in other places where lags are discussed—that much remains to be said on the other intricacies of time in cyclical analysis and on the pranks it may play. Illustrations of more or less isolated investigations abound—A. Aftalion[5] on the gestation period or Tsiang's[6] recent article—but they have still to be drawn together.

III

The second major element in Hicks' theory, and one on which he lays considerable emphasis, is the acceleration principle. For long this theory has been the object of heavy attack, and *prima facie* one would be justified in being somewhat hesitant about a theory of the cycle which relies to so great an extent on the acceleration principle. It would be well therefore if we were to survey briefly the major criticisms aimed at the principle, and then to examine the manner in which Hicks has dealt with them.

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[1] S. Kuznets, *Uses of National Income in Peace and War* (National Bureau of Economic Research, Occasional Paper, No. 6, 1942).

[2] *Trade Cycle*, p. 36.

[3] F. Modigliani, "Fluctuations in the Saving-Income Ratio", in N.B.E.R., *Conference on Research in Income and Wealth, Studies*, Vol. XI (New York, 1949).

[4] J. S. Duesenberry, *Income, Saving, and the Theory of Consumer Behavior* (Cambridge, Mass., 1949).

[5] A. Aftalion, *Les Crises Périodiques de Surproduction* (Paris, 1914); and cf., e.g., J. Tinbergen, "Ein Schiffbauzyklus?" *Weltwirtschaftliches Archiv.*, 1931.

[6] S. C. Tsiang, "Rehabilitation of time dimension of investment in macrodynamic analysis," *Economica*, August, 1949.

The major criticisms are the following:

(a) The acceleration principle is asymmetrical. It may work in the upswing of the cycle but it is unlikely that it will work in the downswing. Surplus capacity thus appears and the principle cannot explain the upturn.

(b) By concentrating on net investment the principle fails to account for the behaviour of replacement investment which may quite well fluctuate so as to offset the ups and downs of the former.

(c) Greater attention should be paid to the effects of anticipations on entrepreneurs' investment decisions.

(d) Many writers have found it hard to believe that there really is any constant connection between the rate of change of output and the rate of change in the stock of capital equipment. In consequence the normally underconsumptionist emphasis of the acceleration principle has been attacked on the grounds that net investment may be reduced not because of a decline in the rate at which sales are growing, but as a result of, for instance, credit or labour scarcity.

(e) Lastly, grave doubts have been expressed about the assumption implicit in the principle that *all* net investment is induced by changes in output. Spontaneous or autonomous investment should also be taken into consideration.

If all these charges are valid, we should certainly have weighty reasons for being sceptical about Hicks' theory.

The first criticism presents no difficulty at all. That the rate of disinvestment in the downswing is restricted in some rough manner by the volume of equipment falling due for replacement is a distinct source of weakness in the acceleration principle; but it is an immense convenience to Hicks that the accelerator can be ignored at this phase of the cycle, leaving untrammelled the interaction of the multiplier and autonomous investment.

In his celebrated critique of the acceleration principle Frisch[1], assuming, as did earlier writers on the principle, that replacement is a function of the current level of output, was able to show that a fall in net investment might be offset by a rise in replacement. Hicks has met this attack by using another and possibly more realistic hypothesis sometimes advanced about replacement: that it depends on the age of the capital equipment. This enables him to escape the difficulty envisaged by Frisch, but at the cost of meeting other perils. If we assume a single and constant life-span for all industrial equipment any "hump" in net investment will be followed at regular intervals by "humps" in replacement, which may offset or aggravate the fluctuations of net investment. Hicks is fully conscious of these difficulties and points to two factors likely to damp these replacement cycles and thus to mitigate their interference with the normal workings of the acceleration principle: all the equipment invested at any one time is not likely to have the same life span; and very little of it is likely to have a precise life span.

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[1] R. Frisch, "The Interrelation Between Capital Production and Consumer-Taking", *Journal of Political Economy*, 1931.

We may wonder, however, if the impact of replacement on the cycle can be dealt with as readily as this. There would appear to be at least one anti-damping force at work. In a downswing where the accelerator has fallen to zero,[1] a considerable volume of replacement will be postponed, and so the ensuing upswing will normally be a period not only of heavy net but also of heavy replacement investment. Is it too much to suggest that as the upswing progresses more and more of the economy's replacement needs will be satisfied and that at least a few years must elapse before firms will think it worth their while to renew their equipment once again? If something of this sort does occur, the saturation of replacement needs which has been suggested by some writers[2] as helping to explain the downturn is not entirely a remote possibility; and it is not dependent on the assumption of some definite age at which equipment must be replaced.

There are some further problems which may be raised here. Perhaps in a world characterised by certainty and the absence of technical change we could distinguish clearly between net and replacement investment, as the acceleration principle assumes we can. But in a world devoid of these characteristics it is difficult to visualise a precise relationship between current output and current investment. At the same time a substantial amount of net or expansion investment takes the form of replacing existing machines with others that are better or larger. In consequence, we cannot very easily follow the acceleration principle and study net and replacement investment separately. Instead we have to handle gross investment influenced by both the movements of output and the age distribution of the equipment, and some such sequence as this might result: in the early part of the upswing both age distribution and rising output will be favourable to gross investment, but as new equipment is installed the former factor becomes progressively more and more inimical and a slowing down of the rate of investment ensues, possibly even bringing the upswing to an end. To say just what will happen would require vastly more research, but there does seem to be some justification for pondering Hicks' treatment of replacement and gross investment.[1]

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[1] This discussion relates only to Hicks' analysis of fixed investment and not to his analysis of stocks.

[2] A useful survey of this literature is to be found in J. Einarsen, *Reinvestment Cycles and their Manifestation in the Norwegian Shipping Industry* (Oslo, 1938).

The cruder versions of the acceleration principle give the impression that the stock of equipment adjusts instantaneously to any increase in demand, and that therefore a rise in demand can be regarded as synonymous with a rise in output. Clearly, however, some time must elapse before new machines can be installed and thus before the rise in demand can be fully met by a rise in output. Hicks meets this difficulty by the introduction of an output lag which is useful for his interpretation of the multiplier and also helps him to give inventory fluctuations a place in his theory. This lag is important, but should he not also have introduced expectations?

The acceleration principle has been described as a disguised theory of expectations.[2] It assumes that output having risen to the level Y_1 will remain at that level, and that therefore net investment will depend on $Y_1 - Y_0$.[3] It would be rash to assume that entrepreneurial expectations always behave in this most convenient manner; but until we know just how they are formed we shall be uncertain about the justice of the acceleration principle's claim that investment is a function of the rate of growth of output. We may illustrate this by reference to a controversy which has appeared on occasion in the literature on the principle: is investment a function of the rate of growth of output or of its level? The answer depends in part on expectations.

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[1] I hope to be able to develop these ideas a little further on some other occasion.

[2] R. M. Bissell, "The Rate of Interest", *American Economic Review*, supplement, 1938.

[3] As usual, the subscripts refer to time periods.

Thus in Kaldor's theory of the cycle[1] we are told that investment depends on the level of output. When output ceases to grow towards the close of an upswing entrepreneurs keep on investing because the level of output is high; but as they are expanding their productive capacity without increasing their output some of their equipment lies idle and this gradually persuades them to stop expanding their plant. This looks remarkably like a lagged version of the acceleration principle; and the entrepreneur certainly will behave in this manner if he believes, not that his sales have risen to their ultimate level but that they will continue to expand. It is not easy to decide whether we should follow Hicks or Kaldor in this matter, but perhaps a monetary factor tilts the scales in Kaldor's favour, especially in an uncertain world where anticipations cannot be precise. The acceleration principle is a real relation, but in the actual world it would be strange if a firm's financial position had no effect on its investment policy through fostering optimistic or pessimistic expectations.[2] Here again we are faced with an intricate and comparatively little-investigated problem, but when output is high firms may possibly be liquid and therefore ready to invest.[3]

The major criticisms of the acceleration principle are aimed at those formulations which attribute the decline in investment to a slowing down in the rate of growth of consumption. The critics deny the validity of this for two reasons: there is no rigorous connection between output and investment, and there are other forces operating in the cycle. The first reason need not delay us long for there are few even among the staunchest defenders of the principle who contend that there is any unbreakable relationship. On the second opinion is divided. Hicks, however, makes it clear that the answer to the question, whether the downturn is caused by the acceleration principle with an inadequate growth of consumption or with labour scarcity,[4] depends very largely on the size of the accelerator or investment coefficient.[1] For small values we get an underconsumptionist explanation of the downturn; but for large values output will explode upwards until labour scarcity causes the crisis. The value of the accelerator thus becomes one of the crucial issues in Hicks' analysis, for he insists that in most cycles it will be sufficiently large to justify a labour scarcity explanation of the downturn. In this he differs from earlier writers who argued that the upper turning point *might* be accounted for in this way.[2]

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[1] N. Kaldor, " A Model of the Trade Cycle ", *Economic Journal*, 1940.

[2] In both Kaldor and Hicks we are concerned with capital widening and not deepening; and presumably widening occurs only where sales are expected to rise.

[3] The problem, however, is bound up with such questions as whether firms prefer internal to external sources of finance; and the effects on their liquidity of investment during the upswing in fixed and working capital. Cf., also M. Kalecki, " The Principle of Increasing Risk ", in *Essays in The Theory of Economic Fluctuations* (London, 1939).

[4] Credit scarcity which protagonists of the acceleration principle are so often accused of forgetting is dealt with in Hicks' chapters on the monetary factor.

Hicks' justification of his assumption takes the form of examining the alternatives and applying a process of *reductio ad absurdum.* Values of the accelerator fall into three main categories. It may have just that value (Hicks' middle point) which yields regular cycles, undamped and unexplosive, through history. It would, however, be " an extraordinary thing if we lived in a world which had got stuck for two centuries with an investment coefficient which was always equal to this precise value! "[3] Where the accelerator has a value below the middle point, damped cycles result. Frisch uses this hypothesis to develop his theory of erratic shocks,[4] but Hicks argues that for the Frischian hypothesis to be fully satisfactory the accelerator must be not merely less than the middle point, it must be very close to it. This value may be rejected for the same reason as the first. We are thus left with values of the accelerator lying above the middle point. Here the necessary conditions are not quite so stringent: the accelerator may alter considerably provided it does not fall below the middle point.

There can be no doubt that this hypothesis about the value of the accelerator is a most interesting one; but we should reserve judgment until the results of empirical inquiry are available.[5] Unfortunately research will not be easy, for, as Hicks shows when he examines the nature of the full employment ceiling, it is not a question so much of an absolute scarcity of labour as of bottlenecks in particular skills, industries, and regions. Aggregate data will have to be supplemented if we are to demonstrate the existence of bottlenecks and prove their importance in impeding the rate of increase of output.[1]

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[1] I use these terms as synonymous, sloth inducing a preference for the shorter " accelerator ".

[2] E.g., G. von Haberler, *Prosperity and Depression* (New York, 1946, edition 3); and R. F. Harrod, *The Trade Cycle* (Oxford, 1936).

[3] Hicks, *Trade Cycle*, p. 89.

[4] R. Frisch, " Propagation Problems and Impulse Problems in Dynamic Economics ", in *Economic Essays in Honour of Gustav Cassel* (London, 1933).

[5] Hicks offers some brief empirical substantiation of his thesis, but finds that he can place " little stress on such rough calculations " (94). If we select at random from some of the literature on the cycles of the interwar period, it is interesting that Dr. Thomas Wilson, for example, attributes to labour scarcity a part in the explanation of the 1920 downturn in the U.S.A., but finds little evidence for such a thesis in 1929. See his *Fluctuations in Income and Employment* (London, 1945). Professor A. H. Hansen in *Full Recovery or Stagnation?* (London, 1938) argues that the acceleration principle was important in explaining the American downturn of 1937, but it is not easy to believe that labour scarcity was significant then.

The final major criticism of the acceleration principle[2] was that it makes the extraordinarily rash assumption that all investment is dependent on fluctuations in output, and preferably those in current output. There can be no doubt that this is a weakness in the acceleration principle, but, as with other weaknesses, Hicks has turned it into a source of strength. He joins Mr. Harrod in insisting on the necessity " of approaching the business cycle as a problem of an expanding economy ".[3] He is thus in a position to draw heavily on the literature in which the problem of the equilibrium rate of growth of such an economy has been debated in recent years ; but he also makes his own significant contribution.

The rate of growth of the Regularly Progressive Economy has been defined in terms of the multiplier and the acceleration principle. As a result it has suffered somewhat from the principle's concentration on induced investment. Hicks shows quite simply that autonomous, or non-induced, investment can be readily integrated into the discussion of the equilibrium rate of growth, so that " it is the growth of autonomous investment which determines the equilibrium rate of growth of the whole system ; and it is its level which determines the equilibrium level of output."[4] In this way autonomous investment is brought fully into Hicks' theory, influencing his cycle at all times and not merely appearing as a *deus ex machina* to explain the upturn.[5] Its importance, however, is most evident at that point in Hicks' narrative.

So far so good, but what is autonomous investment and can we reasonably expect it to rise at a constant rate ? Hicks offers no very satisfactory definition save to suggest that there is certainly some investment on which the effect of past changes in output is so small as to be insignificant. Ample reason for this absence of precision is to be found in the extreme difficulty of distinguishing between induced and autonomous investment, even theoretically. Yet intuitively this distinction does appear to be worth while, for there is much investment, especially in a developing economy, which cannot be related in any intimate way to the variations of output. The acceleration principle cannot cope satisfactorily with the introduction of new techniques of production, nor is it the ideal instrument for analysing the appearance of new products for which markets have in great degree to be created.

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[1] Cf., R. G. D. Allen and B. Thomas, " The Supply of Engineering Labour under Boom Conditions ", *Economic Journal*, 1939.

[2] Cf., above, p. 320.

[3] Hicks, *op. cit.*, p. 8.

[4] *Ibid.*, p. 61.

[5] Dr. James Tobin has pointed out that Hicks' system will, however, eventually produce an upturn even without autonomous investment, provided that there is a constant and negative term in the savings function.

Dr. Hicks has done us a considerable service by forcing us to discuss autonomous investment in the framework of a model which so readily permits the examination of other forces at work in the cycle. He himself bases most of his analysis on the assumption of a constant rate of growth in autonomous investment and in part at least this is a useful emphasis for it is not too difficult to find illustrations of industries which have expanded both in output and investment through even deep depressions, thereby imparting a certain buoyancy to the economy.[1] But taking autonomous investment as a whole it is most difficult to believe that it will always behave in as docile a manner as we would wish. Hicks suggests that financial stringency in the downswing may curtail autonomous investment, aggravating the severity of the depression. He also considers some possible effects its fluctuations may have on the upturn. We are, however, left wondering about its impact on the downturn.

In Schumpeter's emphasis on the growth of risks in the upswing and on the consequent increase in the deterrents to innovation, we have a theory suggesting that autonomous investment tapers off as the upswing progresses. It is interesting to speculate whether we might not combine Schumpeter's theory with Hicks' powerful contribution.[2]

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[1] To some extent, of course, this is offset by the decline in other industries—perhaps in competing lines; but some limit is placed on their depressive effect in so far as their gross investment is not likely to fall much below zero.

[2] Cf., O. Lange, review of J. A. Schumpeter's *Business Cycles* in *Review of Economic Statistics*, 1941.

IV

The main emphasis in Dr. Hicks' theory is on the real factors in the cycle. He does not, however, seek to exclude money entirely from his model. Instead he presents us with a monetary cobweb which contains a stimulating discussion of lags in the credit system.

The fusion, however, of the real and monetary theories is not as happy as it might be. Hicks argues that the principal role of money is to aggravate the depression; but he derives this effect largely from two factors which do not appear in the cobweb: a rise in liquidity preference after the boom has broken, and institutional weaknesses in the banking system. The cobweb relies largely on a sharp rise in the rate of interest in the later phase of the upswing, but Hicks precludes this in his fusion by assuming a highly elastic credit system. Thus the lags which have such an important part in the cobweb theory are much less prominent when the real and monetary theories are linked. For all that, they deserve close study.

This discussion of the monetary factor does leave us wondering whether it may not play an even more intimate part in the cycle. Two possible points at which money impinges on fluctuations have been mentioned. The first, relating to "money illusion" and the consumption function, perhaps involves no more than awkward quirks in the development of the cycle. But the emphasis in the acceleration principle on real factors only is far more serious, and we are left to meditate on the significance of the firm's financial position for its investment policy.

The London School of Economics.

Book Reviews

The Problem of Employment Stabilisation. By Bertil Ohlin. Columbia University Press. London: Geoffrey Cumberlege. 1950. 173 pp. 12s. 6d.

This book is in substance a series of lectures which Professor Ohlin delivered at Columbia and Oxford Universities in 1947. It falls, broadly speaking, into two parts. The last two chapters give an account of the Swedish and the Keynesian theories about the factors which determine the general level of economic activity. This account is inevitably too short to add much to the knowledge of an economist who is working in those fields, though it might afford to the beginner a useful introduction to the subject.

The main interest of the book, however, centres round the five earlier chapters. Here we have the general philosophy of full-employment policies discussed by a man who is a leading economist, a distinguished man of affairs, and a citizen of a country which has carried out notable pioneering experiments in this field. The advice which Professor Ohlin gives is eminently sensible and well balanced.[1] The general prescription is given in Chapters 1 to 3 and may be summarised as follows. By suitable financial and fiscal measures the total demand for goods and services should be so adjusted as to avoid unemployment on the one hand and over-employment on the other; behind this suitably adjusted general level of demand, measures should be taken to remove monopolistic practices and labour immobilities; all important countries should adopt policies of this kind so that balance-of-payments deficits due to domestic inflationary pressures and balance-of-payments surpluses due to domestic deflationary pressures are avoided; other strains on the balance of payments can then be avoided by exchange rate variations, provided that, in the surplus countries in particular, there are no unduly high or rigid obstacles to international trade.

To many readers Chapter 4 will be the most interesting in the book. In it these general precepts are illustrated by an account of the pre-war and post-war measures which have been planned in Sweden to prevent depressions. The Swedish experiment contains many ingenious suggestions; and it should be of great interest to English readers to note both the similarities and the differences between the Swedish and the English ideas.

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[1] The author tends occasionally to underestimate the obstacles in the way of his policies. Thus on page 56 he writes: "Sometimes a country with a weak balance of payments must choose between exchange depreciation and trade restrictions. The first principle then would seem to be to use a variation in the exchange rates, if there is reasonable certainty that the factors causing the weak balance are lasting. In other cases, temporary increases in import duties will often be sufficient. Thus, the scope for the legitimate use of quantitative import restrictions would seem to be rather small. In this respect I find the ideas behind the International Trade Organisation entirely sound." But, alas, the Charter of the proposed International Trade Organisation allows the use of quantitative import restrictions, but does not allow increases in import duties, as a means of meeting a balance-of-payments deficit.

In Chapter 5 Professor Ohlin gives an interesting account of the general implications of a full-employment policy for the structure of society. On the one hand, the achievement of full employment will have great effects upon society. Would Hitler ever have come to power if the Great Depression had not developed in Germany? May it not be much easier to get rid of restrictive practices in the labour market when the fears of mass unemployment are forgotten? On the other hand, many changes in society are necessary in order to achieve full employment. Professor Ohlin dismisses complete *laissez-faire* or what he calls the Manchester Liberal Economic System, and says that if we seek economic stability we must choose between a *semi-socialistic* system and a *social-liberal* society. In the former the problems are solved by detailed quantitative programmes and controls; in the latter a "framework" is obtained by means of the principles enumerated above within which free initiative will itself lead to full employment. The *social-liberal* society which Professor Ohlin advocates is not at all unlike what the present reviewer has advocated under the name of *liberal-socialism*.[1] It is too little realised that this is a form of society which has never yet been tried out over a significant number of normal peacetime years in any country.[2] If the countries of the West will try it, they may be surprised how far it is possible in fact to combine economic security and fair shares with efficiency and freedom.

There is room for critical comment on only one of Professor Ohlin's propositions. He defines full employment (page 5) as "the degree of employment that exists when the aggregate demand for commodities is at the highest level that is compatible with the condition that demand at existing prices is balanced by current domestic supply." When demand is greater than this we have over-employment. Professor Ohlin gives a very fair account of the advantages of over-employment (such as the stimulus in industry to rationalisation, the reduction of wasteful expenditure on selling costs, lessened resistance by workers to labour-saving devices). But he concludes that the disadvantages of over-employment (such as the appearance of bottlenecks which may disrupt the productive process, the growth and wastes of direct controls, difficulties with the balance of payments, and the threat of inflationary upward movements of prices and wages) outweigh these advantages.

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[1] M. Jacques Rueff in his *Épître aux Dirigistes*, page 70, advocates "l'application d'une politique d'intervention libérale, qui sera, pour les uns, un libéralisme social, pour les autres, un socialisme libéral, ... "

[2] The Swedish experiment was initiated only after the Great Depression had developed, and thus was tried only for a very few years before the outbreak of the second world war.

The reader may gain from this the impression that the maintenance of a level of demand which provides full employment but not over-employment will avoid all the disadvantages ascribed to over-employment. But will it ? A level of demand which may be low enough to avoid major bottlenecks in production, for example, may not be low enough to avoid a strong upward pressure on money wage rates. Trade unions are, after all, strong monopolies whose job is to get the best possible price for the labour which they sell. Is there any reason to believe that a level of unemployment (of, say, 3 or 4 per cent.) which is sufficient to allow a reasonable degree of flexibility in the productive process will be sufficiently high to prevent an unduly rapid rise in the general level of money wage rates ? Might not 10 per cent. unemployment be necessary for this purpose ?

And if this is so, what is to be done ? It is neither desirable in itself nor practical politics to advocate the 10 per cent. level of unemployment as the norm for economic policy. Nor is it desirable or practicable to adopt the "trust-busting" solution and disband the trade unions. All that remains is either a continuing inflation or some degree of public control over wage rates. A possible system would be one where all wage disputes went to arbitral bodies whose accepted function was to grant wage increases only where the prospective demand for labour exceeded the supply and to disallow them where this was not the case. Such a system would make it possible to adopt as the target for financial policy the maintenance of full employment at the level defined by Professor Ohlin. Nor, surely, is it illiberal to advocate this degree of state control over a price which is otherwise controlled by a powerful private monopoly. From the point of view of economic freedom control over wage rates is something quite different from the direction of labour to particular occupations.

Is this solution practical politics ? Not at the moment, I fear ; and society has probably to pass through some awkward inflationary phases before it can become so. But there are certain developments which would help its acceptance. On quite other grounds it is desirable to achieve a much more equal distribution of property than exists at the moment ; and as the normal citizen becomes more and more interested in income from property as well as in income from work, the wage will become a question of less exclusive interest. Moreover, it may be hoped that other forms of policy than wage policy—such, for example, as the development of children's allowances—will progressively come to be regarded as the more appropriate means for achieving 'fair shares'. But society has not yet reached this stage. In the view of the present reviewer it is this problem of wage policy which presents the most intractable domestic obstacle to Professor Ohlin's *social-liberal* solution of the problem of economic stability ; and it is doubtful whether Professor Ohlin has given sufficient weight to this difficulty.

J. E. MEADE.

National and International Measures for Full Employment. United Nations. Department of Economic Affairs, New York. 1949. 104 pp. $0.75. 5s. S.Fr. 3.

In October last the Economic and Social Council of the United Nations invited a group of economists to draw up a report on the national and international measures needed for implementing the objective of full employment set up in Article 55 of the United Nations Charter. The group was an international one, consisting of Professors J. Maurice Clark and Arthur Smithies, of the United States, Mr. Nicholas Kaldor, of the United Kingdom, M. Pierre Uri, of France, and Mr. E. Ronald Walker, of Australia. Their Report was drawn up in the very short period of two months, and published before the end of the year.

In view of the short time at the Committee's disposal, it would have been unreasonable to expect any elaborate factual study, and in fact their diagnosis is limited to a clear but brief outline of the general theoretical principles involved, on lines which have now become orthodox: the lack of relation between private decisions on savings and investment, and the consequent inherent instability in internal business activity and employment, especially in countries rich enough to have a large potential margin for saving; and the tendency for a fall in activity in any major importing country to be reflected throughout the world as the result of a reduction in that country's imports and of the consequent worsening of other countries' balances of payments. What are most interesting and novel in the Report are the proposals for checking and reversing these tendencies towards periodical trade depressions, with their accompanying heavy increases in unemployment.

The Committee's recommendations fall into three main sections:—those designed to prevent internal trade depression and unemployment developing as the result of over-saving or under-investment; those intended to eliminate the present tendency towards long-term disequilibrium in the international balance of payments; and those designed to offset any short-term disequilibrium in the balance of payments occurring as the result of the failure of any country to prevent an internal trade depression and a fall in its demand for imports.

To prevent internal trade depressions the Committee urge that countries should prepare in advance and place on a formal basis the various measures which in the past have often been taken belatedly and without any clear plan. Each country should fix for itself an unemployment percentage, or range of percentages, either for the country as a whole or in the most vulnerable sectors, which should be regarded as the full employment level. As soon as unemployment exceeded this level by a given amount, the Government should put into force previously prepared plans for stimulating private investment, for undertaking Government investment and for releasing more incomes for consumption by reducing taxation, preferably direct taxes on earned incomes. Whether action should be taken to induce mainly more investment or mainly more consumption would depend on the position of the country concerned ; under-developed economies would lean rather towards increased investment and those more fully capitalised rather towards increased consumption.

For remedying long-term disequilibrium in the balance of payments, the Report looks mainly to large inter-governmental loans to be made through a new department of the International Bank. Governments of export surplus countries would be asked to fix targets for the total capital exports of their countries over the next five years, and subsequently to make good any shortfall in private foreign investments by increasing their own loans through the International Bank. The International Bank, for the purpose of this new department only, would relax its present rules and allow borrowing governments a wider discretion over the uses to which they put their loans.

Finally, since it is unlikely that, even with the measures suggested in the Report, fluctuations in internal business activity would be wholly eliminated, action would have to be taken to prevent cyclical fluctuations in one country's demands for imports from affecting the ability of other countries to import in turn. It is therefore proposed that any country which developed a balance-of-payments surplus as the result of a fall in imports due to an internal trade depression should place at the disposal of a new department of the International Fund an amount of its own currency equal to the rise in its favourable balance of payments, as compared with a datum period. This currency would be available for re-sale to countries whose balances of payments had been upset by the fall in their exports and who would thus be enabled to maintain the level of their imports unchanged. The effects of one country's depression would thus be prevented from spreading throughout the world.

That these proposals, if fully and intelligently implemented, would have gone far to reduce the magnitude and limit the duration of the 1929–1933 depression is indisputable. They are, in fact, though carefully generalised in form, directed towards providing protection against the effects of a similar future depression starting with a collapse of internal demand in the United States. While, therefore, their proposals may perhaps arouse less opposition than if they had been openly directed to that country (though even so the possibility of their acceptance by Congress is more than a little remote), they are not always wholly applicable to other conceivable situations. For instance, their proposal for replenishing the foreign exchange reserves of other countries, if these should be depleted by a fall in their exports, makes no mention of the pre-existing level of those reserves. This is reasonable enough if we think of the United States as the surplus country ; but if by any miracle a fall in demand by the rest of the world were to reduce the exports of the United States to the point where its gold reserves began to fall, would it really be desirable to interrupt the process of re-distributing gold stocks by placing more pounds and francs at the disposal of U.S. importers ?

A similar concentration on the position in the United States is shown in the proposals for checking an internally induced rise in unemployment. It is possible that the tendency of that country would be to let unemployment rise too far before taking effective measures to check it. But in some other countries the tendency would be to fix the "full-employment" percentage at below the level consistent with the maintenance of stability in a free economy. What the level of unemployment, without either inflation or deflation, would be in a free economy would naturally vary from country to country ; the Report suggests that for most countries it would lie within the range 2–4 per cent., or at worst 3–5 per cent. But as evidence for this estimate they adduce only some very slight arithmetical calculations, some figures for the year 1947 (when inflationary conditions still persisted in nearly all countries) and the *obiter dictum* that "the target in most countries can be set in a much smaller percentage than was regarded as normal before the war". It is surely possible that where the natural and artificial obstacles to the mobility of labour are high, both as between types of occupation and between geographical areas, the percentage of unemployment below which a rise in general demand in a free economy would begin to generate a substantial rise in prices might well be above even the upper level of the estimates given in the Report. In such countries, as Professor J. M. Clark seems to suggest in his additional note to the Report, there would be a very strong tendency to set the unemployment target well below the equilibrium level and to generate a continuous tendency towards inflation and an adverse balance of payments.

F. W. Paish.

American Banking System : a Sketch. By R. S. Sayers. Oxford University Press. 1948. 130 pp. 7s. 6d.

This book is written for the British reader as a comparative study. It emphasises the points in which the American banking system differs from the British. For this very reason the book is also quite interesting for Americans, who will become more conscious of their system's peculiarities. Of course, the points of difference do not necessarily concern the most important problems. It must be kept in mind, therefore, that the book does not aim to be a general introduction into money and banking.

Within his narrow scope Professor Sayers has done an excellent job. The book is small and can only be "a sketch", a little study which wants to give only the essential features without the details. The book does not only describe the American banking system as it exists today ; it shows clearly why it developed in its peculiar fashion and why "the contrast between banking services in America and England is nothing like so sharp as it was forty years ago" (p. 116).

Chapter 1 puts the whole problem of American banking skilfully into its historical setting. Chapter 2 deals with the problems of branch banking, where the differences between American and British banking are particularly great. Chapter 3 discusses the business of commercial banks. Professor Sayers gives a clear picture of the theories behind American banking and of the forces which changed these theories into quite a different reality. The same skilful integration of theoretical, historical and institutional information continues in the following chapters (4 to 6) which concern the Federal Reserve System. Even the American reader, though well acquainted with institutional details, will read this account of the most fundamental changes during the last thirty years with great interest.

The last chapter contains some reflections on the present state of affairs. Professor Sayers comes to the comforting conclusion that "it is now almost unthinkable that in a time of crisis the commercial banks would fail to draw from the Reserve System a supply of reserve cash and notes adequate to meet the needs of the situation" (p. 109). This change for the better was caused by the legislative reforms of 1933 and 1935 and by the greatly increased proportion of Government paper in commercial bank portfolios (plus the Government's stable bond market policy). Of the Government's policy of freezing a pattern of low interest rates into the American economy Professor Sayers is mildly critical. He draws the reader's attention to the consequences to which a situation of high liquidity will lead if the traditional weapons of banking policy are no longer used because a rise in interest rates would reduce the market value of the banks' bond portfolios.

The proposal that the Board of Governors of the Federal Reserve System should be permitted to regulate the proportion of Government paper held in commercial banks has been found unacceptable by commercial bankers. Professor Sayers finds this attitude understandable in view of the fact that there would be little left to justify the existence of commercial banks in the private enterprise system if all they have to do would be the holding of accounts of the public and the holding of part of the public debt.

George N. Halm.

The Economic Theory of Cost of Living Index Numbers. By Melville J. Ulmer. Columbia University Press, New York. 1949.

The object of this small book is to set out the economic theory of cost of living index numbers and to advance a "practical development of the theory". The theoretical section is a neat and convenient exposition of the familiar theory in terms of the indifference map. It includes, in an appendix, an account of the various methods proposed for deriving cost of living index numbers from budget data. It is, however, unfortunate that Dr. Ulmer makes no use of Hicks' work, particularly "The Valuation of the Social Income" (this journal, May, 1940), though he includes the article in his bibliography.

All this is useful but not new. What really concerns the author is the need to give some support to the feeling that most users of index numbers have that in practice the Laspeyres and Paasche formulæ provide double limits to the cost of living index, though theory sets only one of the forms as a limit. His practical argument proceeds as follows.

Let I_0 be the true index comparing periods 0 and 1 at the level of real income of period O and I, the true index for the income level of period 1. Let L and P be the Laspeyres and Paasche forms of the index comparing periods 0 and 1. Then all that theory gives, on the assumption of an unchanged indifference map, is:

$$P \quad I, \text{ and } I_0 \quad L \qquad \dots\dots\dots\dots\dots\dots\dots (1)$$

Denote $D_i = I_0 - I$, and $D_t = L - P$, where these can be of either sign. But, from (1):

$$D = D_t - D_i \quad 0 \qquad \dots\dots\dots\dots\dots\dots\dots (2)$$

Also from (1) and (2):

$$L - D \quad I_0 \quad L \qquad \text{and} \qquad P \quad I, \quad P + D$$

A knowledge of D, or even a maximum value of D, would fix the "error" in using L and P as limits of the index. In practice, only D_t is known and, if this could be substituted for D, L and P would be the limits of the index. Unfortunately, D_t can be large or small and of either sign so that, *in any one comparison*, D_i does not help in fixing limits. What Dr. Ulmer advances is that, *over a range of different comparisons*, the range of values found for D_i will be a conservative and practical estimate of the "error" D since D_i will be sometimes positive and sometimes negative in different comparisons. Specifically, if we can assume that mean $D_i = 0$ and cov $(D_i D) = 0$, then from (2)

$$\text{Mean } D = \text{Mean } D_t \qquad \text{and} \qquad \text{var } D \quad \text{var } D_t$$

Dr. Ulmer's practical conclusion is that, in any one comparison, we should not obtain only $D_t = L - P$—which can be a faulty guide to the limits of the index—but that we should examine the range of values of D_t obtained in a variety of similar comparisons between various periods. This seems a useful point, though perhaps it is a more limited advance in the practical application of index number theory than Dr. Ulmer would appear to maintain.

R. G. D. ALLEN

Labor Productivity Functions in Meat Packing. By William H. Nicholls. University of Chicago Press. 1948. xvii + 256 pp. $5.

This book presents the results of a statistical study of the relationship between input of labour and physical output in a large American meat processing plant. Professor Nicholls points out that the scope of the study is limited. It is not concerned with capital equipment at all. The writer thinks that the technical conditions in the plant in question are such that the capital equipment may be taken as practically fixed in the short period. The statistical method used in the study is the familiar least square method, physical output being correlated with labour input. Professor Nicholls, working as he was at Iowa State College and (latterly) Chicago University, is not unaware of the limitations of the " single equation " method which he employs. In fact the book contains two chapters which deal with the shortcomings of the single equation approach and the advances made by the recently developed " simultaneous equation " method. These chapters outline the reasons why it is not always possible to derive the structural economic relationship in which we are interested without taking into account other relationships that influence the empirical data from which we work. As the author explains, this means that we have in principle to set up a " complete model " in which all the important relationships are included, so that we work with a set of simultaneous equations. The reader is, therefore, given ample warning of the limitations of the single equation method of deriving production functions. However, it is this latter method only which is used in the statistical work in the study under review.

Professor Nicholls' object is to establish production functions relating physical output with the input of labour. The basic data for his computations are time series of physical output on the one hand and manhours worked and total payrolls on the other. The author uses three different measures of labour input. Two of them —total manhours and total payroll—have been commonly used in the past. There is, however, a third alternative. As the writer points out, labour may be considered as having two dimensions: the total number of men in the labour force and the average time worked by each man. The same number of manhours (or payroll) may result from widely varying combinations of size of labour force and length of work week. Professor Nicholls' statistical material enables him to throw light upon these questions of the optimum working week, the optimum size of a labour force and the flexibility of plant operations. This part of his study is of particular interest.

In the analysis the writer, inevitably, comes up against the question of multiple-shift work. He tells us that scatter diagrams drawn up from his data indicated " discontinuities in the labour productivity . . . functions where a change in the number of shifts was involved ". He therefore treats data referring to double shifts separately from the single-shift data. Clearly, the number of shifts worked is one of the factors influencing measures of productivity in industry. On the purely technical side, costs would be minimised by working plant for 24 hours a day *less* a short spell required for cleaning, cooling, etc. The fact that in reality most plant runs for something nearer eight hours than 24 is of course due to institutional and psychological costs (increased wages for night work, legal restrictions, higher transport costs, etc.). In view of the very large discrepancy between the purely technical optimum day for machinery, and the day actually worked in industry, this point seems important. Up to now productivity studies do not seem to have answered the question: what are the (institutional and psychological, as well as purely technical) cost functions which fix the actual optimum degree of shift work? Professor Nicholls' study cannot answer this question—one would have to consider capital as well as labour costs. However, his study of optimum work week *per man* is a necessary first step.

Having restricted himself to the single-equation method, and having chosen his three alternative measures of labour input, Professor Nicholls considers two general hypotheses: that output is a second degree function of labour input, or (alternatively) that it is a logarithmic function of labour input. For the first hypothesis, a general conic equation of the second degree is assumed, and alternative multiple regression equations are fitted for each set of data. The " best-fitting " equation, on the basis of the F-test, for each set of data is given in Table I. For the second hypothesis the writer uses the Cobb-Douglas function, output being assumed to vary as some power of the labour input. (This hypothesis is, however, not tried out for the third labour measure: namely payroll.) The author finds that the results obtained under his two alternative hypotheses " do not, for the most part, yield consistent results ". Briefly, on the basis of the conic regressions, the preponderance of evidence pointed to diminishing productivity of both men and hours; whereas the logarithmic regressions indicated increasing productivity of both. When labour was measured by total manhours, the two hypotheses led to conflicting results in three out of five cases.

In the light of these statistical results, and of the limitations of the method used, we cannot—as the author points out—feel sure that the analysis has yielded valid (structural) production functions. This question is thrown up again when the equations are used to derive isoquants, i.e., functions describing the different combinations of number of men and length of work week which yield any given output. Professor Nicholls finds that for two of his sets of data the isoquants have the expected shape, that is they give a determinate optimum combination of men and hours (minimum-cost point). But for the rest the derived isoquants are shaped so as to give no minimum cost. In considering these results it should be borne in mind that the number of observations is not large. The results may, as the writer suggests in some cases, arise because the data for length of work week do not vary enough. But if this were a valid explanation of all the " wrongly " shaped isoquants, it might lead us to question whether any of the equations from which the isoquants are derived are in fact structural production functions. To say this, however, is to contribute nothing to the solution of the problem. In this field of statistical derivation of economic relationships it is much easier to cite weaknesses than to remedy them. Although it seems to me doubtful whether reasonably reliable structural production functions can be derived without introducing at least two " factors " of production and at least one other relationship besides the production function itself, nevertheless the simpler analysis may, I believe, be extremely useful. It is not always possible or desirable to plunge straight into the full complexities of a complete model. Partial analysis may in some cases give a first approximation to the coefficients we seek. Even if it does not, it teaches us a lot about our problem—about the nature and measurement of our variables, and the traps to be avoided. It may well be that the quickest and surest way to achieve a more complete analysis is to start by working through the less complete one. Professor Nicholls' contribution is undoubtedly of great interest and assistance to those working on the statistical derivation of production functions, including those who are struggling with more complex models.

H. MAKOWER.

Hundert Jahre oesterreichischer Wirtschaftsentwicklung, 1848–1948. Ed. HANS MAYER. Springer-Verlag, Vienna. 1949. xiii + 714 pp. £3 (stiff cover £3 6s. 0d.).

For a country which in economics has given her name to the school of thought most famous the world over, Austria has hitherto been poorly served in the field of economic history. On celebrating its centenary in 1948, the organisation of Austrian Chambers of Commerce plays its part in filling the gap by issuing this volume, in which 11 authors —members of the Faculty of Economics of Vienna University or prominent administrators in industry and trade—contribute articles on the development of the Austrian economy during the last hundred years. Currency and fiscal policy, internal and foreign trade, public policy towards industry and the small producer, the development of transport, social policy and legislation and the history of the Chambers of Commerce are all treated in separate reviews. Not all articles are of equal quality, but all abound with valuable material for anybody wishing to obtain a detailed factual knowledge of the working of the Austrian economy. The editor of the work is Professor Hans Mayer, a prominent representative of the Austrian School of Economics and successor to Wieser's chair at Vienna University.

Austria's financial policy, more than that of most countries, was subservient to the necessities of foreign relations, complicated in the days of the Habsburg monarchy by centrifugal tendencies within the empire. State finances up to 1867 were one long succession of desperate expedients, due not to exceptional incompetence among those responsible for their management, but to the desire of a comparatively poor and slowly developing country to sustain an ambitious and aggressive foreign policy. After the " Ausgleich " of 1867, the Dual Monarchy enjoyed a long period of peace, marked in the currency field by the disappearance of the silver premium in 1878 and the adoption of a gold bullion standard in 1892. The chief difficulty in this period was the need for agreement between Austrian and Hungarian authorities for any decision to become operative ; as the interests of agricultural Hungary and industrialised Austria diverged, the currency management mechanism was slow and cumbrous (a lesson to be borne in mind, should a European currency management authority ever be created).

We can look upon Austria in the 19th century as the eastern boundary of economic liberalism or as the western outpost of a sustained State paternalism. The effects on her of Adam Smith's teachings were slow and never as vigorous as in countries further west. Symptomatic in the tariff field is the attitude of the Chambers of Commerce (which represented producers as well as merchants). Their general budgetary proposals were similar to those of the Financial Reform Associations in Britain in the second half of the century, but—unlike these—they always remained in favour of what they considered a reasonable amount of protection for domestic industry, and objected to the tariff treaties concluded by the Dual Monarchy at the height of its free-trade period with the Zollverein and Britain in 1868–9. Similarly in industrial organisation, free entry to a trade never remained an undisputed principle for long. Opposition against it found legal expression in the 1880s ; this tendency can be traced to its culmination in the corporative State of the 1930s.

As the centenary of the Chambers of Commerce gives rise to this publication, much attention has been devoted to their significance in Austrian economic life. Readers familiar with British developments would be mistaken in looking upon the Chambers as merely the equivalent of their British namesakes. As an outcome of the Great Reform Act, the English middle class obtained a share in political power—and in due course in the government—sufficient to ensure that its case did not go by default. The Austrian revolution of 1848 was equally a middle-class movement, backed by a hungry and despairing working class and peasantry, but had less success. The form of government remained absolutist until at least 1861, when parliamentary control of the budget was introduced. Austria after 1849 was ruled by an absolute monarch, aristocracy and bureaucracy, none of them familiar with industry and trade. There was a complete cleavage between political and economic power, the latter in the hands of the middle class. An organisation was needed to act as its spokesman, first reconciling within its own ranks the divergent interests of producers of different sizes and areas, merchants and bankers, then representing these interests to a government in which the middle class had no share. Until the English middle class was enabled to partake in the government, it had to rely on common-law judges to protect individual liberty against the State ; in Austria, where the middle class lacked powerful defenders, it fought for its right at least to be heard in an advisory capacity. All contributors to this work testify that the Chambers of Commerce filled the part of interpreters of middle class interests worthily, without ever neglecting the wider national aspects. A certain bias, imparted by the Chambers' position within the economy, may be detected in the omission of a separate history of Austrian agriculture. This is explained in the introduction by a reference to the comparative unimportance of agriculture in Austrian economic life in the last century. As, however, figures are elsewhere quoted showing the extent to which, after the treaty of St. Germain, Austrian agriculture succeeded in making good the loss of the agricultural surplus areas allotted to the Succession States, it is hard to agree to this judgment. We may take a passing hint that the Chambers of Commerce never succeeded in reconciling their differences with agricultural interests as the real reason underlying the omission.

Nothing in this volume would make the reader imagine that there ever was any Austrian who welcomed the National Socialist invasion or had Fascist leanings of his own. Nor would there be any need, in a book devoted to economic development, to allude to such disagreeable matters, were it not for strong—though tactfully worded—complaints by some contributors about restrictions still maintained by the occupation authorities in Austria. To mention the effect of a causal connection without sparing a word for the cause paints, to say the least, a lopsided picture.

Most outside observers of Austria, as left by the treaty of St. Germain, have wanted to know whether, as an economic unit, she could possibly survive. Palacky, in his famous utterance in 1848, suggested that if the Danube Monarchy did not exist, it would have to be invented; but he spoke of political considerations, justifying a framework within which "subject nationalities" could be protected. In 1908, his countryman Edvard Beneš believed the dissolution of the Empire to be impossible for economic reasons. The authors of the present volume answer the question by implication only, but apparently believe that Austria, as at present constituted, can exist. In support, they point to the amazing buoyancy of her national revenues, which have weathered more crises than those of most other countries, and to the quality of the men who have at one time and another laid aside gown and pen to take government office. In a country whose economic and financial policy has been guided by Böhm-Bawerk, Wieser, Schumpeter and Mayer, this argument must carry great weight.

WALTER M. STERN.

Government Financing of Private Enterprise. By D. R. Fuller. Stanford University Press. London: Geoffrey Cumberlege. 1949. 206 pp. 16s.

In Dr. Fuller's thesis, the object of which is to study the purpose of, and the merit underlying, the many proposals for government financial assistance to business which have been made in the U.S. in recent years, the discussion is primarily concerned with the problem of the institutional " gap " in the market for medium- and long-term loan and equity capital for small business.

The evidence collected by Dr. Fuller suggests that American small business has been finding it increasingly difficult in recent years to obtain medium- and long-term finance at other than an " undesirably high " cost. The ploughing back of profits, " the major source of equity capital in the past ", has been restricted by the large increases in tax rates since the early thirties ; the incentive to undertake risky investment generally has been reduced for the same reason. To these factors must be added the growing importance of institutional investment through insurance companies, savings banks, trust funds and the like which are either precluded from investing in equities or which prefer to choose the more marketable securities of the bigger corporations, the similar preference of the investing public generally for the securities of the well known " national " companies, and the lack of special facilities for marketing capital issues of up to say $100,000 (U.K. readers will compare the £200,000 figure of the Macmillan Report).

Now " gap " is a word easily used, but as Dr. Fuller points out (p. 12) " . . . if the supply and demand for funds are equal at the prevailing rates of interest, how can the failure of a given enterprise to secure financing be said to constitute a gap ? " Here, as in other fields, governmental action may be considered desirable on grounds of deliberate social policy, e.g., because small business should be fostered in order to promote social well-being. In this case the public should at least know the cost of the policy.

Dr. Fuller is well aware of the implicit inconsistency in the suggestion to set up government-sponsored institutions to provide " risk " capital for small business (and as he points out, in small business long term loan capital may carry a substantial element of risk). Among other things some degree of supervision of the business activities will be inevitable, with a resultant introduction of rigidity into the business concerned. Moreover, as Dr. Fuller notes, there appears to be considerable reluctance on the part of owners of small businesses to relinquish part of the equity of their business to outsiders. (It is understood that a similar reluctance on the part of would-be borrowers has been met by the U.K. Industrial and Commercial Finance Corporation.)

Dr. Fuller's conclusion that government should provide neither ownership capital nor long-term loans for small business (p. 185) is therefore not surprising. Nor, he concludes, should there be government interference with the interest rate structure such as to constitute a subsidy in the form of " lower than market rates to individual borrowers " (p. 191). On the other hand he appears to be in favour of the establishment of local investment companies or capital banks financed with private equity capital (p. 187). He admits that the high cost of supervision of small loans and equity holdings might make it difficult for such companies to earn adequate returns and suggests that the formation of such companies could be spurred on by the granting of special tax benefits. But what is this but that subsidisation that Dr. Fuller has rejected? He also suggests an "adjustment of tax rates in favour of small business and if feasible in favour of investors willing to accept substantial risks" (p. 184). This would amount so far at least as the first part of the suggestion is concerned to a direct subsidy of small business. Dr. Fuller makes the alternative suggestion that income tax rates be lowered for business in general in order to increase the availability of retained funds as a source of investment which would not represent a differential advantage to small business as such. It appears, however, that Dr. Fuller has implicitly accepted the desirability of encouraging small business on social grounds even if this involves some degree of subsidy, direct or indirect.

In the author's survey of the field which government-sponsored finance has so far covered in the U.S. the most interesting part from the point of view of the main theme of the book is the two chapters devoted to the activities of the Federal Reserve Board and the Reconstruction Finance Corporation in providing medium-term loans or loan guarantees for business from the period of the emergency legislation in the early thirties. These operations provide the chief source of experience in relation to government-provided finance of this type, although in neither case was equity capital provided.

The author also devotes considerable space to the study of governmental provision of non-business credit and to governmental wartime financing of business. One would have preferred in place of these a more detailed study of the problems involved in government intervention in the field of business finance—the yardsticks by which loan rates would be fixed, the assessment of risk experience (surprisingly little information about its loss experience seems to have been made available by the R.F.C.), the criteria to be adopted by government agencies in deciding whether to grant loans or provide equity capital in particular cases. Dr. Fuller refers to the formation in the U.K. in 1945, by the Bank of England and commercial banks, of the Industrial and Commercial Finance Corporation with the object of providing on commercial principles the type of finance he is discussing. It seems a pity that the policy and experience of this company, so far as information about them is available, are given only a cursory mention.

Those interested in the problem of the maintenance of the supply of risk capital will find a number of useful references.

H. C. EDEY.

Methodenlehre der Statistik. By Gerhard Mackenroth. Vandenhoeck und Ruprecht, Göttingen. 1949. 210 pp.

This volume is one of a series entitled "Grundriss der Sozialwissenschaft", which is designed to cover the whole field of the social sciences.

Its author set himself the task of writing a book which would enable students, research workers, economists and business men, who were not themselves statistical experts, to employ the basic techniques of statistical analysis and to assess the value of statistical data more critically. It can be said that, on the whole, Mr. Mackenroth has succeeded admirably in his purpose.

His book follows the conventional pattern of modern elementary textbooks and should prove valuable to the student attending his first courses on the subject. There are chapters on the fundamental concepts of statistics, the classification and tabulation of statistical data, the analysis of frequency distributions, index numbers, correlation and time series. Some criticisms of the content may be made. The chapter on correlation is not satisfactory. In the first place, hardly any treatment of contingency is given, although that term appears in the title of the chapter. Secondly, it would be useful to have the correlation ratios, as well as the product moment coefficient, included in the chapter. Thirdly, there should be some account of rank correlation. Lastly, and most important, it is regrettable that there should be no discussion of regression. Its exclusion may simplify the presentation of elementary correlation, but is bound to leave the student with a very incomplete appreciation of the subject.

On sampling, too, a more extensive treatment is necessary. The subject deserves a chapter of its own, with fuller discussion of the testing of significance and some reference to the methods of selecting representative samples. Finally, on the question of content, it may be asked whether a great deal would not be gained by including an introduction to the analysis of variance in even as elementary a book as this.

The method of presentation of the book is excellent and one aspect, in particular, will make the book very suitable for anyone attempting to learn the subject on his own. Throughout the chapters, examples are set, involving the use of all the techniques covered in the text; at the end of the book, detailed solutions are given with full comments on *alternative* methods of tackling and setting out the calculations, and of presenting and interpreting the results.

C. A. Moser.

Unemployment Insurance in Great Britain, 1911–48. By Sir Frank Tillyard assisted by F. N. Ball. Thames Bank Publishing Company Ltd., Southend-on-Sea. 233 pp. 21s.

This book is a carefully documented legal history of unemployment insurance in Great Britain since its inception.

The first 8 chapters (pp. 1–172), which cover the period 1911–41, are written by Sir Frank Tillyard and they comprise a careful summary of the highly complicated legislation of that period following the parent Act of 1911. Due emphasis is given to the work of the

Unemployment Insurance Statutory Committee which is awarded a separate chapter of 30 pages. This section of the book, however, is marred by the presentation of the wealth of material available. It is difficult in any case to follow the many financial changes in unemployment insurance throughout the period but the significance of the main changes can only be grasped if the data are recorded in tabular form. Parts of these chapters make unnecessarily dull reading merely because of the insistence of the author on recording every change in unemployment insurance contributions and benefits in the text.

Mr. Ball, who is concerned with developments from the Beveridge Report to the present day (chapters 9 and 10) adopts a much more critical attitude and does not shrink from pointing out some of the omissions and obscurities in recent legislation. He has also skilfully related the sections of the Act of 1946 dealing with unemployment insurance to their interpretation by the Minister of National Insurance and others in the Reports of the Standing Committee on the National Insurance Bill and to contemporary debate. So far as the far-reaching financial changes introduced by the new Act are concerned, Mr. Ball places a little too much emphasis on the part played by the Minister in financial affairs and fails to note the extensive powers conferred on the Treasury.

Although the book deals primarily with legislative changes, it is extensive enough to save the social scientist much hard labour in the pursuit and perusal of the host of official documents relating to unemployment insurance.

ALAN T. PEACOCK.

Economic Calculation in the Socialist Society. By Trygve J. B. Hoff. William Hodge and Co. Ltd. 1949. vii + 264 pp. 21s.

Dr. Hoff is an economist with a wide knowledge of the literature of socialist economics, particularly in English and German. He is also editor of *Formand*, a Norwegian fortnightly of liberal views. *Economic Calculation in the Socialist Society* is the type of book one would expect from such a background. It is a balanced survey and appraisal of writings on the subject of socialist economic calculation prior to 1938, when the book was first published in Norwegian. Various types of societies are examined, with the proposals for calculation put forward in regard to each, and conclusions well in the Professor Mises-Professor Hayek tradition are reached.

The book begins with a discussion of definitions and assumptions. The problem of choosing between alternative value (and therefore cost) theories is circumvented by adopting an embracing definition of economic calculation. Study of the consequences of applying particular value theories can then be left until individual societies are examined. Thus Dr. Hoff later demonstrates that a Marxist-communist society, applying a labour theory of value to the task of resource allocation, might logically manufacture toy swords of molybdenum : an expensive method, by capitalist standards, of training youth to defend itself against Fascist beasts.

The consideration of ends which follows naturally lacks mention of the recent discussion of ends and optimum conditions by welfare economists, which culminated in the formulation of the Social Welfare Function. Such refinement would scarcely be to the author's purpose in any event. He is concerned solely to show that the problem of calculation can be discussed only within a framework of given ends. Optimum conditions are little discussed ; the problem of the optimal distribution of a given product is regarded as lying within the ends assumed. This is not entirely logical, particularly as freedom of choice, which might similarly be considered as a given part of a society's ends, is examined in detail in relation to each type of society studied. As a result, the end which Dr. Hoff accepts for his socialist societies implicitly includes an unexamined " solution " of the problem of distribution. This end is :

> " The maximum exploitation of the community's resources with the object of satisfying the needs of its members including that of leisure." (p. 30).

Alongside this may be placed another definition. A socialist society is described as one in which :

(1) The private ownership of the means of production is abolished.

(2) Business initiative is invested in a central authority which alone directs industrial activity. (p. 15).

In the light of these definitions, a " natural " (i.e., moneyless) economy and various types of " Marxist-communist " economies are discussed, the different problems arising from the presence or absence of freedom of choice and occupation being considered in each case. The place of profit, interest, rent and depreciation in such societies is also examined.

A logical solution of the problem of economic calculation is admitted in monetary societies eschewing freedom of choice. In a society making authoritarian decisions without taking individual wishes into account, all data necessary for calculation are obtained by the authority's arbitrary price-fixing—" since the central authority . . . fixes all prices, it can, irrespective of how it calculates and what use it makes of things, logically claim that its calculation is economic ". Such a society might be able to calculate—but is it what socialists want ? Only Dr. Dobb is cited as having accepted the conclusions of an argument couched in such terms.

If freedom of choice is retained, economic calculation is held to be impossible. Dr. Hoff examines four groups of suggested solutions and criticises each in turn. He also makes the general objection that central direction is logically incompatible with freedom of choice.

The four groups of solutions examined are: the solution of Paretian equations, the trial-and-error method, the equation of marginal productivity and price, and the creation of competitive corporations. Dr. Hoff considers the last of these to be the most reasonable, but criticises such "competitive autonomous corporations" on the grounds that large corporations would act as monopolists; small ones would coalesce or originate cartel agreements. Monopoly elements are in any event held to be inevitable in the case of land, primary raw materials and power.

These, however, are all administrative rather than logical difficulties; the only logical problem would seem to lie in the incompatibility of central planning, freedom of choice, and a market for productive factors. The conclusion of the argument is thus inherent in the nature of the definition chosen for a socialist society. If we remove the assumption that the central authority "alone directs industrial activity", the competitive solution is seen to be logically valid. The author might have brought this relation between assumption and conclusion more clearly to the fore. That he is aware of it is shown by his appraisal of competitive corporations, which he regards as the most reasonable solution of the problem, and at the same time the closest approximation to the capitalist system which is to be replaced.

There are thus two types of socialist society which can possibly undertake economic calculation; those which eschew freedom of choice and those which abandon central planning. But if the most successful solution of the problem of socialist economic calculation so nearly approaches the competitive capitalist solution, might it not be better to abandon central economic planning, and attempt to achieve the remaining ends of socialism by other means? Or, if this is not thought practicable or desirable, is there no "middle-way" solution for a problem which is, in essence, the economic manifestation of the fundamental conflict of freedom and authority?

Dr. Hoff is not concerned with these questions, which have increasingly attracted the attention of economists during the past decade. But it is a great merit of his book that it compels the reader to face them.

There is an interesting appendix on the actual working of the Russian system, and a useful bibliography. The appendix, however, consists largely of quotations from a host of other writers; it is therefore difficult to know just what weight can be given to particular statements.

The translation is adequate; technical language has in general been faithfully rendered. But there is one abomination which deserves quotation in full:

> "... many will be more interested in the necessaries in their own hand, than in those in the bush of the future, which they do not know that they will ever live to see." (p. 42).

J. WISEMAN.

The Development of the American Glass Industry. By Pearce Davis. Harvard University Press. London: Geoffrey Cumberlege. 1949. ix + 316 pp. $6. 32s. 6d.

Professor Pearce Davis is Professor and Chairman of the Department of Business and Economics at the Illinois Institute of Technology. His book is not altogether an economic history since the economics sometimes hangs on by the skin of its teeth to the technology, which is perhaps inevitable in so restricted a field as the study of glass manufacture.

Professor Davis' theme is the transformation of the glass industry in America from a labour-intensive, handicraft-type occupation into a large mass-production industry. The main economic argument is that the mechanisation of the industry which led to this resulted, not from tariff protection, but from the accumulated impulses of high wages, profit incentives, and technical ingenuity. This is surely more obvious than Professor Davis seems to think. For so long as the industry in the nineteenth century was basically labour-intensive in type, the tariff provided a shelter behind which glass manufacture was able to expand quantitatively, and domestic production to secure a high share of the home market, without irresistible pressure toward mechanisation.

The glass industry, for such reasons as the physical properties of the materials employed, presented especially difficult problems for mechanisation. In America, even under the impact of the introduction of the use of natural gas which greatly affected the location of the industry, technique remained below European levels in certain important sectors of glass manufacture. The industry continued until about 1900 to be a craft industry, governed largely by the bilateral monopoly of labour and management. It seems from Professor Davis' exposition on this point that the process of mechanisation on a considerable scale was finally induced by a very usual stimulus. Since the machines had been invented, someone finally succeeded in using them profitably and thus in forcing a reshuffling of the elements within the bilateral monopoly. Once the process had been set moving, American technological standards began to surpass those of European glass manufacturers. The time when this began to happen is not made quite clear.

Thus, in the U.S.A., where as in several European countries the glass industry had begun with migrant labour and handicraft techniques, it had become a heavily capitalised mass-production industry.

It is possibly inevitable that a study of the glass industry, in a way which is perhaps most useful in adding a modicum of economics for technicians and business men, should be of somewhat restricted interest. But certainly business men as well as economists would like to know, and surely the business men at least do know, something more profound about the economics of glass manufacture. They know and might perhaps like to know more about the cost structure of the industry and about the demand for its products. A case in point is the inelasticity of demand, mentioned by Professor Davis in the context of the nineteenth century, for window glass, the demand having been effectively given by the situation in the building trades. But there is surely a great deal more which it might be interesting to consider.

As far as tariffs are concerned, in the later period (1900–1925), the effects varied for different sectors of the industry depending on how far production costs were reduced. To the extent that any sector depended almost wholly on labour skill, America did not become a cheap glass producer. Beyond 1925, unfortunately, Professor Davis does not take his story. By that time, with handicraft-type production largely a thing of the past in most parts of the industry, a new and different age of expansion was beginning in the American glass industry.

A. L. MINKES.

SHORTER NOTICES

The Keynesian Revolution. by LAWRENCE R. KLEIN. Macmillan and Co. 1950. xii + 218 pp. 15s.

This book, which is already well known, is now available for soft-currency readers. It is probably one of the best introductions to Keynesian theory, since, unlike some of the others, it takes account of the discussions since 1936. This does not mean that it is ideal, however, and many readers will be irritated in particular by the patronising tone Dr. Klein uses in discussing pre-Keynesian ideas. Full employment is made to seem easy of attainment, and the problems of socialism to be only a matter of estimating the saving function. Pundits will find the appendix useful.

Ordo: Jahrbuch fur die Ordnung von Wirtschaft und Gesellschaft. Zweiter Band, 1949. Helmut Küpper Verlag, Godesberg. 388 pp.

The 1949 edition of *Ordo* retains the interest of its predecessor reviewed in this journal in May, 1949. It also confirms the impression that the most active and influential group of economists in post-war Germany is the "Euckenkreis," whose leader, the late Professor Walther Eucken of Freiburg, died recently in tragic circumstances while on a visit to the University of London.

The contributions commanding attention are the articles by Professor Eucken himself, Albert Hahn, Frederick Lutz and the late Heinrich v. Stackelberg. Professor Eucken's discussion of the competitive order and its realisation is the positive counterpart to his attack on interventionism in the 1948 edition. Albert Hahn, it is to be regretted, does Keynes a disservice by a rather clumsy attack on the *General Theory*. Professor Lutz writes clearly, concisely and informatively about international monetary policy.

The short fragment by v. Stackelberg on planning problems is of some historical interest; an indication of its content is given in the article on "Recent German Contributions to Economics" published in the May issue of *Economica.* Other contributors include Professor Miksch now of Freiburg and Professor Rustow of Istanbul.

Banking Policy and the Price Level. By D. H. Robertson. Reprinted, with a new introduction. 1949. Augustus M. Kelley, New York. $1.75.

In this book, first published in 1926, Professor Robertson presented an austere step-by-step analysis of his case for questioning (1) the compatibility of stability of output and stability of prices and (2) the universal desirability of stability of output. The book has been out of print some long time, and this American reprint will be welcomed by all interested in the development of monetary thought during this century. The new introduction will help the student to follow the tortuous course of this development—and will whet the appetite of all economists for a comprehensive restatement of Professor Robertson's own position.

Probleme der öffentlichen Finanzen und der Währung. Festgabe für Eugen Grossmann. Polygraphischer Verlag A.-G., Zürich. 1949. 317 pp. S.Fr. 25.

This volume is a "Festschrift" celebrating the 70th birthday of Professor Eugen Grossmann, a recognised authority on Swiss financial problems. 23 writers, colleagues and pupils of Professor Grossmann contribute articles on public finance and monetary practice but these are not by any means all confined to Swiss problems.

Some of the articles may be of interest to economic historians; for instance, the coinage policy of the Swiss confederacy during the 30 years' war discussed by Dr. Nabholz. The names of Lorenz v. Stein, Adolf Wagner and Emil Sax deserve to be better known in the literature of public finance and Dr. Bickel and Dr. Schorer provide useful essays in 'Dogmengeschichte', with discussion of these authors' works. Of the essays on current monetary problems, probably Dr. Paul Gygax's outline of Swiss credit problems from 1930–1948 is the most informative.

The book includes a complete bibliography of Professor Grossmann's publications over a span of 45 years as well as a list of students' dissertations prepared under his supervision.

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The Problem of Integrability in Utility Theory[1]

By Paul A. Samuelson

I. Historical Survey of the Integrability Issue

A chapter in the history of utility theory has now been brought to a close by Mr. Houthakker's[2] important discussion of integrability. As far back as 1886, G. B. Antonelli[3] had noted that such a problem existed and seems to have given the correct "integrability conditions". But to most economists this problem was first introduced by Irving Fisher's[4] 1892 study—perhaps the best of all doctoral dissertations in economics. Even here it is introduced pretty much as an afterthought so that it is no great wonder that Pareto's *Manuale di economica politica*[5] (1906) should have neglected this topic—even though Pareto was clearly aware of Fisher's work and had discussed integrability in journal articles as far back as 1893.

Vito Volterra[6] in his 1906 review of the *Manuale* performed one of the few services professional mathematicians have ever rendered to economic theory: he pointed out that when Pareto treats the case of three or more goods, his discussion of indifference directions is marred by the failure to recognise explicitly the integrability problem. Pareto admitted his mistake and discussed the problem a few months later in the same journal; most of this discussion is repeated in the improved French version, the *Manuel d'économie politique* (1909) and deals with the puzzling problem of "open and closed cycles" of consumption.[1] Professor E. B. Wilson,[2] when he reviewed the *Manuel* in 1912, expressed the opinion that the economist could throw out of court the integrability problem, however natural it might be for mathematicians to worry about it. He also expressed the interesting opinion that as a result of some remarks of J. Willard Gibbs, Yale's distinguished physicist, Fisher may have changed his mind concerning the admissibility of non-integrability.

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[1] Dedicated to the memory of Joseph A. Schumpeter, who had a lifelong interest in the logical foundations of utility theory.

[2] H. S. Houthakker: "Revealed Preference and the Utility Function", *Economica*, May 1950.

[3] G. B. Antonelli: *Teoria mathematica della economica politica*, Pisa (1886). This seems to be a rare item. I know of it only from the extension of Jevons' *Bibliography of mathematical economic writings*, and from the detailed reference by Wold in a paper later to be cited.

[4] Irving Fisher: "Mathematical Investigations in the Theory of Value and Prices", *Transactions of the Connecticut Academy*, Vol. IX, July 1892, and reproduced in a 1925 Yale Press edition, pp. 88–9. Recognition of non-integrability seems almost an afterthought in Fisher; since he uses his teacher, Gibbs' vector notation, Gibbs may have suggested the problem to him. If in 1892 Fisher was willing to entertain the hypothesis of non-integrability, it none the less seems that in all his later work he really believed in integrability.

[5] V. Pareto: *Manuale di economica politica*, Milan (1906). I have not checked the non-mathematical text to see whether Pareto had really neglected non-integrability completely.

[6] V. Volterra: Review of Pareto's *Manuale*, in *Giornale degli economisti*, Vol. 32 (2nd ser., 1906), pp. 296–301. Cf. Pareto's reply, *Ibid.*, Vol. 33, pp. 15–30.

W. E. Johnson's classic 1913 paper on utility[3] makes no mention of the integrability problem (nor for that matter of the work of Fisher and other important earlier writers). Eugen Slutsky[4] in his remarkable, but too little known, 1915 Italian article showed that the existence of an integrable utility surface had definite testable implications for cross-elasticities of individual's demand: i.e., a "compensated change" in the price of good i must have exactly the same effect on the quantity of j demanded as does a compensated change in the price of j have on the demand for i.

In his *Mathematical Groundwork of Economics* (1924) Professor A. L. Bowley does not, as far as I can see, anywhere deal with the problem of integrability. Professor G. C. Evans, an eminent mathematician, gives one of the most extensive discussions of this problem in *Mathematical Introduction to Economics* (1930).[5] Most of the arguments for non-integrability are contained in his treatment; these will be discussed in some detail later.

We may now move into the modern era, which I arbitrarily date from R. G. D. Allen's foundation article of 1932.[6]

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[1] V. Pareto: *Manuel d'économie politique*, Paris (1909) pp. 539–57, 249–51.

[2] Edwin B. Wilson, Review of Pareto's *Manuel*, in *Bulletin of the American Mathematical Society*, Vol. 18 (1912).

[3] W. E. Johnson: "Pure Theory of Utility Curves", *Economic Journal*, Vol. 23 (1913), pp. 483–513.

[4] E. Slutsky: "Sulla teoria de bilancio del consumatora," *Giornale degli economisti*, Vol. 51 (1915), pp. 1–26. See also R. G. D. Allen's description of this paper in *Review of Economic Studies*, Vol. 13 (1935–6), pp. 120–9.

[5] Ch. IX, pp. 119–22.

[6] R. G. D. Allen: "The Foundation of a Mathematical Theory of Exchange", *Economica*, Vol. 12 (1932), pp. 219–23. See also J. R. Hicks and R. G. D. Allen: "A Reconsideration of the Theory of Value", *Economica*, Vol. 14 (1934), I, pp. 52–76 and II, pp. 196–219; R. G. D. Allen: *Mathematical Analysis for Economists* (1937), pp. 438–42, 509–17.

This was a necessary preliminary for the later articles of Hicks-Allen and for their separate later writings. Allen was unacquainted with Slutsky's work but refers to most of the other important early writers. He entertains the hypothesis of non-integrability; and if I dare impute any differences to the separate components of the Hicks-Allen composite commodity, I would say that Hicks consistently rules out the non-integrability case, while Allen accepts it as the more general hypothesis. At least Allen in his 1932, 1934, and 1937 treatments deals at length with non-integrability, while Hicks in his 1934, 1937, and 1939 treatments goes out of his way to make it clear that he is against non-integrability.[1] Hicks-Allen also noted an empirical implication of integrability that is the inverse of the Slutsky reciprocity relation: under integrability, when tea is a substitute for coffee *vis-à-vis* a third commodity, then according to their same 1934 definition, coffee must be numerically equal as a substitute for tea.

As a partial digression, I should mention the 1932 work of Hotelling on the related problem of profit-maximisation by a firm *not* subject to a budgetary constraint.[2] Integrability conditions arise there which are related to, but distinct from, those that arise in the case of a consumer under budgetary constraint.[3] In this connection, the reader can be referred to Henry Schultz' 1937 book which gives an extensive discussion of the integrability question: while not itself an entirely satisfactory resolution of the problem, Schultz' pages give a very good summary of the uncertainties that pervade the literature.[4]

Professor Nicholas Georgescu-Roegen, now of Vanderbilt University, wrote in 1936 one of the most important

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[1] J. R. Hicks: *Economica*, Vol. 14 (1934), p. 53; *Théorie mathématique de la valeur* (1937), p. 7; *Value and Capital* (1939), p. 19.

[2] H. Hotelling: "Edgeworth's Taxation Paradox and . . . Demand . . . Functions", *Journal of Political Economy*, Vol. 40 (1932), pp. 577–616.

[3] However, if we are willing to make very special assumptions of a good with constant marginal cardinal utility, we can write $U(x_1, \dots, x_n) = x_1 + V(x_2, \dots, x_n)$ for proper choice of units. This is to be a maximum subject to the budget constraint $1 \, . \, x_1 + p_2 x_2 + \dots p_n x_n = I$; and thus, with income effects emasculated, the consumer can be thought of as maximising *without* constraint

$$V(x_2, \dots, x_n) - p_2 x_2 - p_3 x_3 - \dots - p_n x_n + I$$

which is precisely of the Hotelling 1932 form. (See pp. 592ff.) Later Hotelling addressed himself directly to the consumer problem and restated definitely some of the reciprocity conditions implied by integrability on the partial derivatives of price ratio functions of quantities of goods. H. Hotelling: "Demand Function with Limited Budgets", *Econometrica*, Vol. 3 (1935), pp. 66–78.

[4] H. Schultz: *Theory and Measurement of Demand* (1937), pp. 17–18, 575–81, 623ff. The bibliography is very complete.

clarifications of the problem of integrability and also of the even more subtle problems of transitivity.[1] Until re-reading his article recently, I did not realise how much it must have stimulated my own work on the subject, as embodied in two 1938 articles and later.[2]

In 1943, Dr. Herman Wold of Uppsala University, Sweden, wrote three illuminating articles on demand analysis entitled "A Synthesis of Pure Demand Analysis".[3] Since these appeared in a rather specialised journal and during wartime, it is to be feared that they may suffer the neglect that was long the fate of Slutsky's fundamental paper. I know in my own case, although I was honoured with reprints, they arrived at a time when I was temporarily out of economics; I am ashamed to say that I have only recently read them after some correspondence with Mr. Houthakker; and I am even more ashamed of failure to cite these important papers in my *Foundations of Economic Analysis* (1947).[4]

Although the above list of references cannot pretend to be exhaustive,[5] it does bring us down to the present time and to Mr. Houthakker's important contribution.

2. The Meaning of Integrability: Two-dimensional Case

I do not think there is any simple way of picturing integrability conditions so that we can easily grasp their meaning in common-sense intuitive terms. This is because the picture must be in three-dimensional space at least, and because it must concern itself with subtle "local" conditions that slopes must obey. But I shall make the attempt to convey a notion of what is involved. After this is done, we shall be in a better position to appraise the main arguments in favour of and against non-integrability.

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[1] N. Georgescu-Roegen: "The Pure Theory of Consumer's Behaviour", *Quarterly Journal of Economics*, Vol. 49 (1935–6), pp. 545–93.

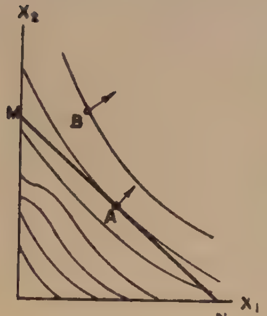
[2] "A Note on the Pure Theory of Consumer's Behaviour", *Economica*, Vol. 18 (1938), pp. 61–71, 353–4; "Empirical Implications of Utility Analysis", *Econometrica*, Vol. 6 (1938); "Consumption Theory in Terms of Revealed Preference", *Economica*, Vol. 28 (1948), pp. 243–53.

[3] H. Wold: "A Synthesis of Pure Demand Analysis", I, II, III: *Skandinavisk Aktuarietidskrift* (1943), pp. 85–118, 221–63, (1944) pp. 69–120. See especially pp. 109ff. and pp. 78ff. The reference to Antonelli is on pp. 115 and 118.

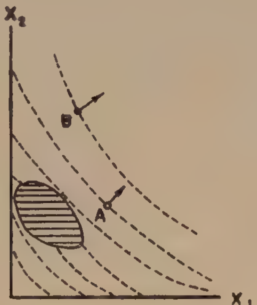
[4] Ch. V.

[5] For example, there are papers by L. Court and R. Roy on related problems. Also there is a recent paper by de Ville which I know of only from a brief review by K. Arrow in *Mathematical Reviews*, 1947.

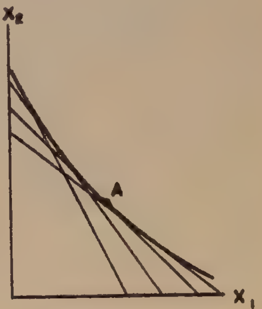
Let us begin in two dimensions where the problem of integrability does *not* arise. Imagine that you go to the south-west corner of a room. Look down at the floor, and let the corner be the origin from which goods x_1 and x_2 are to be measured. On the floor can then be traced the contour lines of indifference looking like Figure 1a. (The little arrows show the direction of preference of the indifference curves and are drawn perpendicular for convenience.) The same thing is pictured in Figure 1b, but as a consumer might *reveal* his preference field to us if we could observe his demand behaviour only externally. Thus, at point A the consumer had his choice of all the points on the straight line MN. But he chose A, and we draw a little line through A with a slope equal to the price ratio $(-p_1/p_2)$ that brought him into equilibrium at A. Similarly at B or any other observed point we can draw a little "slope-element" (and if we like, a little arrow of preference); the budget lines whose price ratios determine the little slopes are, for simplicity, omitted. Figure 1c is another way of looking at the same problem. Any indifference curve, such as the one through A, can be thought of as the "envelope" or sheath of a family of budget lines, with only the heavy dark points being empirically observed.



1A



1B



1C

It will be noted that any point where the indifference curves are convex rather than concave *cannot be observed in a competitive market.* (Cf. Fig. 1b.) Such points are shrouded in eternal darkness—unless we make our consumer a *monopsonist* and let him choose between goods lying on a very convex "budget curve" (along which he is affecting the prices of what he buys). In this monopsony case, we could still deduce the slope of the man's indifference curve from the slope of the curved constraint at the equilibrium point. The case of a Gallup-poll questioner who finds out the man's preference contours by giving him choices of every pair of goods is simply a limiting case of monopsony. And if we experiment sufficiently, we can always find a curved family of unique contours representing his ordinal preference field—if such a consistent field exists. Therefore, in this generalised monopsony we can behaviouristically identify the man's ordinal preference field if he has one.[1]

But I shall confine myself for simplicity to what will reveal itself under perfect competition and shall be concerned only with concave regions. In a recent article on "Consumption Theory in Terms of Revealed Preference",[2] I discussed how the little slopes of Figure 1b can be mathematically integrated into the smooth contours of Figure 1a. If the little slope elements are made very small and very numerous, our mind's eye sees them as joining together into a one-parameter family of contours: it is as if iron filings on the floor line up to reveal the magnetic lines of force determined by a magnet under the floor. If the observed price ratio p_1/p_2 is given as the following continuous and differentiable function of the two goods, $B(x_1, x_2)$, then mathematical analysis assures us that the differential equation

$$(1) \qquad dx_2/dx_1 = -B(x_1, x_2)$$

gives rise to a unique family of curves as in Figure 1a. In two dimensions there is no integrability problem.

Before leaving the two-dimensional case, I should give preliminary warning concerning two red herrings that are confused with the integrability question. First, a consumer may be myopic in the sense that he does not know what his tastes are like in situations quite different from his customary position; consequently his short-run demand behaviour may differ from the long-run "normal" behaviour which alone is our concern. But to be myopic means to be short-sighted—not zero-sighted or infinitesimal-sighted. We shall see in our multi-variable discussion that finite sight, however local, implies integrability; but the two-variable case drives home the irrelevancy of the problem of short-sightedness for the problem of integrability—since even if we choose to assume literally infinitesimal-sightedness, we still end up with a one-parameter family of contours and no integrability problem is possible.

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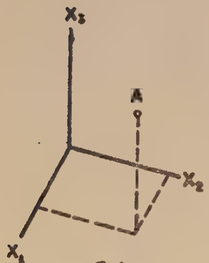
[1] In his last and most general formulation, *Encyclopédie des sciences mathématiques*, Tome I, Vol. IV, Fasc. 4 (1911), Pareto wished simply to assume that an individual's equilibrium choice would be given as an observable *functional* of every and any constraint offered him But Pareto did not sufficiently realise that the functionals so defined would have to be highly restricted so as to give consistent results and define a consistent ordinal preference field. See N. Georgescu-Roegen: "Note on a Proposition of Pareto", *Quarterly Journal of Economics*, Vol. 49, 1934–5, pp. 706–14. Professor Kenneth Arrow of Stanford University in a set of as yet unpublished papers has given a formulation of such consistency conditions in terms of logical sets.

[2] *Economica*, November 1948, pp. 243–253.

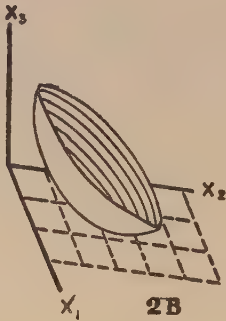
Secondly, there is the related confusion between the "order of consumption" followed by a consumer and the "dependence of certain line integrals on the path" between two points. It must be emphasised that the paths along which I as an economic scientist choose to evaluate the man's preference have absolutely nothing to do with the order in which the human guinea-pig *consumes* the goods. I don't know whether he drinks his beer before his whisky or his whisky before his beer; I don't know whether it even makes sense to say that he enjoys his shelter *before* rather than after he enjoys his food. Note too that in going from A to B the guinea-pig does *not* eat his way along the path, and in going from B to A regurgitate along the same path. Rather we should always regard the budget of goods at A as a steady flow of consumption per unit time, optimally patterned to the consumer's tastes. And the flow of consumption goods at B is again a steady flow long maintained. *The comparison of A and B* (and of intermediate points) *is a case of comparative statics.* We need not invade the privacy of the consumer's castle to concern ourselves with the minutiæ of his domestic arrangements.

I stress all these complications because they are complete irrelevancies. And yet they arise in the two-variable case where there is absolutely no integrability problem! It should be absolutely clear, therefore, that the problem of "the order of consumption", in the sense of the path along which the consumer actually moves behind the scenes of the market-place, has nothing to do with the problem of integrability versus non-integrability.

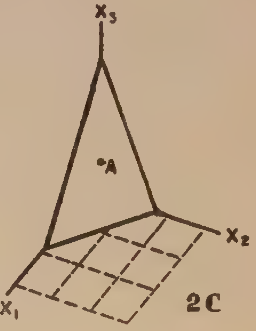
Pareto only confused the issue in his discussion of "open and closed cycles of consumption". Actually, Pareto seems to end up with the conclusion that the consumer can be thought of as following optimal paths behind the scenes. From this he infers, if I understand his puzzling treatment, that there is no longer any ambiguity of path and therefore *integrability* is assured. This is all hopelessly confused: even if the consumer has definite and optimal domestic-housekeeping habits, we shall still have to *add* strong restrictions on his revealed-preference behaviour once we have more than two goods. To repeat, Pareto's primary confusion results from his identifying the paths of integration chosen by the economist-observer for statical comparisons with the behind-the-scenes programming of pleasures by the consumer.



2A



2B



2C

In our two-variable case we have already integrated our indifference elements and have arrived at indifference contours. To repeat again: no integrability problem is possible and no integrability conditions need be fulfilled.[1]

3. The Three-dimensional Picture: The Integrable Case

When we bring a third good x_3 into the picture, we must use the altitude above the floor as the direction along which we measure the third good. Now we have three axes which meet in the south-west corner of our room. Along the lower edges of the wall, x_1 and x_2 are paced off as before. But the x_3 axis is measured along the vertical of the corner. Figure 2a shows the three axes. Any point in the room represents a combination of all three goods, as shown by A.

If we assume that the consumer has a consistent ordinal preference field, then we shall now have indifference *surfaces*, rather than indifference *curves*. How do these surfaces look? Rather like thin bowls inside of bowls, with the bottoms of the bowls pointing downward and south-westward toward the corner origin. As long as he moves on one bowl, the consumer is indifferent. As he moves toward " outside " bowls, nearer and nearer to the origin of zero consumption, he is worse off. As he moves away from the origin toward inner bowls, he is better off. Of course, this is all an imperfect picture: bowls are too thick, and umbrellas might be better.

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[1] See Mathematical Notes below.

Of course, any movement on an indifference surface will involve giving up something of one or more goods and taking on something of the other goods. Any movement off the surface and toward the origin involves a loss of ordinal satisfaction. Any movement off the surface in the opposite direction will involve a preferred move. If the consumer were free as a bird, he would want to get as far from the corner origin as possible, going upward and outward beyond the confines of the room and in the direction of bliss. But if we give him a limited money income, I, and prices of all goods, p_1, p_2, p_3, then he is not free as a bird. He cannot even move freely within the room. Instead he must stay inside the budget plane defined by

$$p_1x_1 + p_2x_2 + p_3x_3 = I.$$

Figure 2c shows the limiting budget plane beyond which the consumer cannot go. If every good is desired by the consumer, he will never stay inside the budget plane but will instead choose to crawl on its surface seeking his most preferred position. If A is such an optimum position, at that point the budget plane will be touching but not crossing the highest attainable indifference surface; hence there will be tangency, with the " bottom " of the indifference bowl just resting against the plane in the same way that a tea-cup rests against its saucer.

Of course, if income or prices change, then the budget planes will change and a new optimum point of tangency will be found[1]: thus we define the general demand functions showing how each good will depend on all prices and income.

Thus far I have sidestepped the problem of non-integrability by assuming it away. I have implicitly assumed that the consumer does have a *consistent ordinal preference field*: that he can always tell of any two situations either that A is

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[1] If the indifference surfaces do not have the usually assumed curvature, the consumer may rush away from certain parts of the room; he may even rush to one of the walls or floor and enjoy only a " generalised tangency ". This often happens, but need not be studied here.

"better than" B, or B better than A, or that they are indifferent; and that his preferences among three or more situations are transitive in the sense that "if A is better than B and B better than C, then A is better than C", etc. In short, I have assumed that indifference surfaces do exist. But need they?

THE THREE-DIMENSIONAL CASE: NON-INTEGRABILITY

What is it that as scientists we are able actually to *observe* of a consumer who is in market equilibrium? Only his demand functions in response to all possible prices and incomes. Or, in geometrical terms, all that we can observe are points like A which lie on an observable budget plane and which represent an optimum as compared to other points on or inside that plane. The reader will be tempted at this point to ask: "Just as we traced out indifference curves in the two-dimensional case as the envelope of carefully changed budget *lines*, can we not hope in the three-variable case to trace out the bowl-like indifference surfaces as the envelope of carefully changed budget *planes*?" The answer must be worded cautiously: "Provided that the indifference surfaces exist, *yes* we can hope to trace them out in this way. But in the three-variable case there may not exist anything corresponding to such surfaces—unless certain extra restrictions are placed on the consumer's demand behaviour."

To investigate further the conditions of integrability and non-integrability, let us paint in just what it is that we can observe in our geometrical room. At any point such as A, we have the budget plane going through A; our stage will get too cluttered up if we leave everything on it, so for simplicity we need at A indicate only a little "piece" of its budget plane. We need only indicate at A a little button, or better still a little thumb-tack, whose back or head lies in the budget plane and whose point tells us which is the "preferred" direction. At every observable point in our room there will be a little thumb-tack suspended in space; its exact orientation in space is indicated by its point, or equally well by the head, which lies perpendicular to the point. Of course, the thumb-tack is just a non-rigorous way of picturing a little "planar element" determined at each point by the two price ratios at which equilibrium takes place: if we let x_3 be our *numéraire* or good whose price is taken as unity, then p_1/p_3 and p_2/p_3 will be assumed to be single-valued continuously differentiable functions[1] of x_1, x_2, x_3, written as $p_1/p_3 = B^1(x_1, x_2, x_3)$ and $p_2/p_3 = B^2(x_1, x_2, x_3)$.

Our little planar elements or thumb-tacks are often referred to as " marginal rates of substitution " between the goods in question, or as " little indifference elements ". It is said that so long as we take a " little " step on the surface of the thumb-tack, the consumer is just " indifferent "; if we step off the thumb-tack toward its point, the consumer is moving in a " preferred " direction ; finally, a move off the tack in the opposite direction is toward a " less-preferred " direction. In the present delicate investigation I must regard this as rather dangerous terminology. We have no right to regard our little elements as anything but shorthand ways of representing the observable price-ratios that give orientation to the observable budget plane passing through the observable optimum point. As behaviourists we have not yet earned the right to speak of " indifference " and " preference " ; and we certainly have no right to speak of " indifference directions for *infinitesimal* or *small* movements ", especially since the underlined words are by no means unambiguous or mutually equivalent.

But no one can stop us from asking a purely mathematical question : " Can we ' join together ' the little thumb-tacks to form bowl-like surfaces ? " This involves the purely mathematical properties of the partial differential equations

$$-\frac{\partial x_3}{\partial x_1} = B^1(x_1, x_2, x_3) \ , \ -\frac{\partial x_3}{\partial x_2} = B^2(x_1, x_2, x_3)$$

and of the so-called " total differential expression "

$$B^1(x_1, x_2, x_3)dx_1 + B^2(x_1, x_2, x_3)dx_2 + 1\ dx_3.$$

Can we define unique bowl-like surfaces by setting the last expression equal to zero ? The mathematicians know the answer to this,[2] but the meaning of their integrability conditions will not be understood until we investigate the geometrical picture further.

Few people can visualise well in three dimensions. And fewer still can correctly see what must be true about things infinitesimally close to each other. Therefore, few will be able to visualise the answer to the question of whether the thumb-tacks can be joined together to form surfaces. Let us therefore try to bring the matter down to two dimensions by the following device. Let us see what the planar elements or thumb-tacks look like *on any two-dimensional surface.* Let us put a thin wafer of wax in our room, bent so as to represent any desired surface. Now put in our whole field of thumb-tacks. Some tacks will not touch the wax surface; but some will have to be pushed sideward into the wax so as to lie in their specified positions. Hence, our surface will be covered by the "tracks" of the planar elements.

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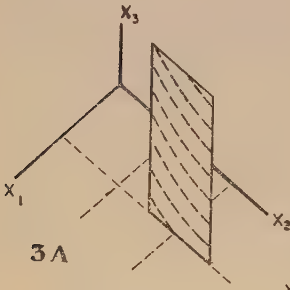
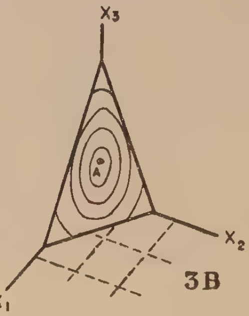
[1] We cannot in all cases invert our demand functions to express p's in terms of x's. But if appropriate " curvature assumptions " are made, this will be possible within certain regions. See Mathematical Notes below.

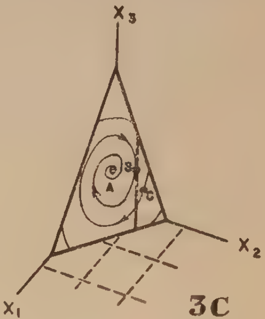
[2] See Mathematical Notes below.



3A



3B



3C

These tracks on the wax surface will look like the little line segments of the earlier two-dimensional picture. This is because the wax surface itself has only two rather than three dimensions.

Figure 3a, for example, shows how the little price ratios look on a plane which represents x_1 held constant, but with x_2 and x_3 varying. The little slope elements can obviously from our earlier two-dimension discussion always be joined together by the reader's eye to form a family of contours (which at this stage it would be dangerous to call indifference curves). In our remaining figures we shall assume that all such two-dimensional slope elements have been integrated into smooth contours. Figure 3b shows contour lines observed on a budget plane of a guinea-pig called Jeremy; while 3c shows observations recorded by a scientist under similar conditions for a consumer called Gustav.[1]

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[1] Of course, Jeremy need not be a hedonist of the Bentham type: he is the 20th century stream-lined version who believes only in *ordinal* utility; and Gustav is more sophisticated than was the Cassel who rejected utility in favour of demand functions and nothing else, but was never fully aware of what he was thereby assuming or denying about empirical reality.

Note that at a point like A, where the planar thumb-tack is just tangent to our wax surface, we do not get a unique directional track, but instead get a dot with indeterminate direction. This remark will probably give the reader a hint as to how we might try to find indifference surfaces such as that pictured in Figure 2b. Why not cleverly bend a wax surface so that everywhere on it we get dots of indeterminate direction? Professor Georgescu-Roegen in the 1936 article cited earlier was the first to show that this can indeed be done in the case of a consumer like Jeremy, whose tracks on any budget plane around an optimum point are always closed ellipse-like contours as in Figure 3b. *But it cannot be done for a consumer like Gustav who leaves spiral-like tracks on his budget planes* as in Figure 3c. This, then, is the geometrical meaning of the non-integrable case. Thus, by careful enough examination of the tracings left by a consumer's demand functions, we can determine whether he is a Jeremy or a Gustav.[1]

So-called Open and Closed Cycles

I shall return to the spiral-like contours left on the budget plane in the non-integrable case later and shall show how this provides us with an alternative proof to Mr. Houthakker's theorem that the "strong axiom of revealed preference" (whereby a consumer never reveals a contradiction of preference in any *chain* of index number comparisons) definitely rules out non-integrability. But first I should like to use our geometrical model to throw light on Pareto's problem of open and closed cycles.

We have seen that Pareto confused the paths used by the scientist for comparative-statics comparisons with that actually followed by a consumer in consuming his goods. He did something else, less objectionable, but that I should like to avoid. He tried to define numerical or cardinal indexes of utility along such a path; I on the other hand should like to remain in the objective realm of commodity space.[2]

With two goods there is no problem: every cycle is "closed" in the sense that Pareto can always find a utility index defined by an integral which returns to its old value once we get back to A. But with three or more goods, it may turn out that cycles are "open": we pass from A to B and then back to A and our integral indicates to us that A is "better than itself".[1]

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[1] See Mathematical Note 6 below.

[2] The present exposition, which was suggested to me by a reading of Houthakker's paper, was elegantly developed by Dr. Wold, *loc. cit.*, I, pp. 104–17.

That this phenomenon is independent of all cardinal utility considerations can be shown by Figure 4. We examine the contour lines traced in the wax by the little price-ratio planar elements. We have three wax surfaces

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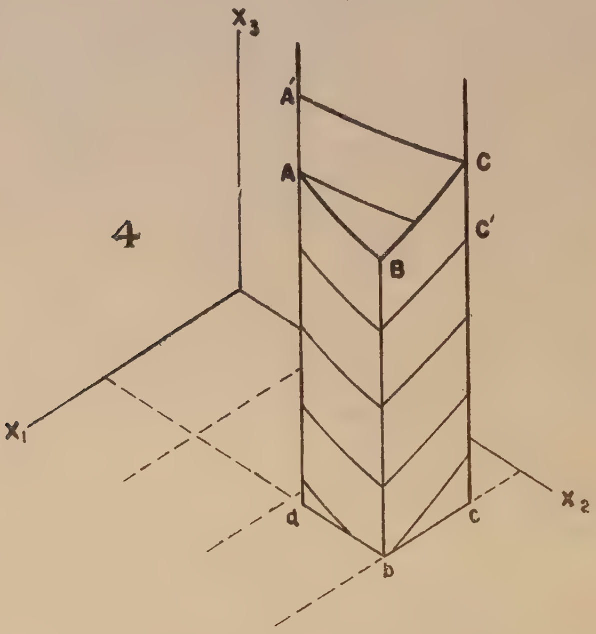

that form a kind of three-sided tower. (The old Flat-iron building in New York City was actually of this general shape.) One wall rises perpendicularly to the "street" *ab*; another rises perpendicularly to the "street" *bc*. The third wall which is the back of the building could not be seen at all except that I have cut away part of the top to make it visible.

Instead of windows, there appears on each of our walls contour lines. I hesitate to call them "indifference curves", but will do so, putting the expression in quotation marks. Let us start Gustav out at the point A. Let us hold x_1 constant and give him more x_2; to keep him on the same contour, we must take away something of x_3. Therefore, we move Gustav along the dark contour from A to B. Now we hold x_2 constant and decrease x_1; to keep Gustav indifferent we must then compensate him by increasing x_3, moving him along the dark contour BC. Likewise, by increasing x_1, decreasing x_2 and increasing x_3, we move him along the back wall, along the contour through C all the way to A′.

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[1] See Mathematical Note 4 below.

Gustav is obviously a rather strange chap. We have never crossed an " indifference " contour and yet we end up at the same amounts of x_1 and x_2 as at the beginning, *but with* x_3 *necessarily greater by the amount* AA' ! A man with such woolly preferences can be easily cheated. If Gustav would agree to our moving him anywhere along his " indifference " contours, we could take away x_3 from him by walking him around A′CBA, and we can continue the spiral downward until we have deprived him of indefinitely much x_3.[1]

This could not happen to a Jeremy. For him, A′ and A will exactly coincide: such is the meaning of the integrability condition that his demand function must obey.[2]

But once again I must remind the reader that the paths followed, leading to open or closed cycles, have nothing to do with the process by which a consumer moves toward equilibrium or with the order of his personal consumption agenda.

Revealed Preference and Integrability

We are now in a position to complete the programme begun a dozen years ago of arriving *at the full empirical implications for demand behaviour of the most general ordinal utility analysis.* My own work in this direction grew out of a remark made to me by Professor Haberler in his 1936 international trade seminar at Harvard. " How do you know indifference curves are concave ? " My quick retort was " Well, if they're not, your whole theory of index numbers is worthless ". Later I got to thinking about the implications of this answer (disregarding the fact that it is not worded quite accurately). Being then full of Professor Leontief's analysis of indifference curves, I suddenly realised that we could dispense with almost all notions of utility: starting from a few logical axioms of demand consistency, I could derive the whole of the valid utility analysis as corollaries.

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[1] This argument is really illegitimate: Gustav, not being a Jeremy, would have no reason to agree that we are free to move him along his " indifference " contours. The word " indifference " is probably *not* in his vocabulary.

[2] See Mathematical Note 5 below.

My fundamental axiom I borrowed from modern index-number theory. I shall call it (for reasons that will be obvious) the Weak Axiom of Consumer's Behaviour:

> Weak axiom: If at the price and income of situation A you could have bought the goods actually bought at a different point B and if you actually chose not to, then A is defined to be "revealed to be better than" B. The basic postulate is that B is never to reveal itself to be *also* "better than" A.

I soon realised that this could carry us almost all the way along the path of providing new foundations for utility theory.[1] But not quite all the way. The problem of integrability, it soon became obvious, could not yield to this weak axiom alone. I held up publication on the conjecture that if the axiom were strengthened to exclude non-contradictions of revealed preference for a chain of three or more situations, then non-integrability could indeed be excluded. At scientific meetings and in correspondence this problem was proposed, both to economists and mathematicians. But no proof was forthcoming for all these years, until Mr. Houthakker's paper arrived in the daily mail. Not only had he provided the missing proof, but in addition he had independently arrived at precisely the same strong axiom as I had hoped would save the day. To his paper which is such a model of logical elegance and compactness, the present historical treatment of the subject can hope to serve only as a supplement.

In words, the strong axiom can be worded roughly as follows:

> Strong axiom: If A reveals itself to be "better than" B, and if B reveals itself to be "better than" C, and if C reveals itself to be "better than" D, etc. . . . , then I extend the definition of "revealed preference" and say that A can be defined to be "revealed to be better

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[1] For example, in a single step, one arrives at most of the properties of the Slutsky S matrix in the Mathematical Notes below.

> than" Z, the last in the chain. In such cases it is postulated that Z must never *also* be revealed to be better than A.[1]

What Mr. Houthakker has shown is the following: Any Gustav, whose demand functions correspond to a non-integrable preference field, can be made to contradict the strong axiom. By judiciously varying prices and income, we can make him (on our strengthened definition of revealed preference) assert that A is better than Z and Z is at the same time better than A. Houthakker has shown how we should pick prices and income so as to reveal this contradiction. He has given us the long-sought test for integrability that can be formed in finite index-number terms, without need to estimate partial derivatives.

Figure 4 shows the same thing, but not so elegantly in that quantities and not prices are the independent variables. As Houthakker, Little and I have shown, we can pick a sequence of points very near to the path ABCA′ but lying just inferior to it, *along which the individual is asserting himself to be getting worse off*. We finally end up just below A′, but definitely above A—and it is obvious at this point that our consumer has revealed himself to have become " better off " since A′ and anything near it costs more than A. Here, we have a contradiction: the point between A and A′ is revealed to be *both better and worse* than A as a result of assuming non-integrability. Therefore, every cycle must be closed, and integrability is assured by our strong axiom. This is a variant of Houthakker's proof.

A second variant uses the spirals shown in Figure 3c. Just as there passed an optimal budget plane through A, so too there will pass an optimal budget plane through the point B. This will show up *on the original budget plane of A* as a line, tangent to B. Any point, like C which lies beyond this line on the side opposite to A, will lie *inside* the new budget plane and will reveal itself to cost less than B and thus be inferior to B. But we can find a sequence of points (such as C, D, E, . . . etc.) which hug near to the spiral through C but which march clockwise all the way around to just to the right of A and which always reveal themselves to be "worse than" C. But it is also clear that all points near to A can reveal themselves to be "better than" B. Thus, we have a point near A revealed to be both better and worse than C. This is our desired contradiction, and again we end up with the inadmissibility of non-integrability.

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[1] I have glossed over a few delicate points. Thus, not all of the situations have to be different ones. Also, there is the question of how to handle two situations which at A's prices *cost the same*, but where A was chosen. If we rule out the possibility that B is " indifferent to A ", then we rule out some realistic cases of multiple equilibrium points. Even when B costs less than A at A's prices, in ruling that A is " better than B " we are making some implicit assumptions about the absence of " saturation-effects ". Throughout this paper I have dodged delicate problems of this sort, taking refuge in overly-strong assumptions about regularity of curvature. Since all this needs a definitive treatment, I must apologise for glossing over the difficulties.

For purposes of identification, let us call a man a Paul if he satisfies the weak axiom for single-pair comparisons, whether or not he satisfies the strong axiom for any chain. Without going into next section's arguments concerning the merits of integrability *v.* non-integrability, this much seems clear to me: if a man is not a Jeremy with an integrable preference field, that is understandable; but why should anyone be a semi-irrational Paul without going all the way and being a Gustav? Or alternatively, why should an irrational Gustav make a bow in the direction of being consistent and stop short at being a Paul, refusing to take the final step toward becoming a Jeremy? In short, I should expect there to be few Pauls reported by experienced observers.

SUMMARY OF ARGUMENTS FOR NON-INTEGRABILITY

Let us now use the above analysis to appraise briefly the main arguments that have been advanced for non-integrability.

(1) There is the celebrated argument of Pareto, already mentioned, concerning the order of consumption and the question of open and closed cycles. Enough has been said already to indicate that I agree with the majority of writers that this is a confused discussion in at least the following respects: (*a*) *comparative statics* has little to do with the behind-the-scenes *order of consuming;* (*b*) even if the individual is presumed to follow the optimal order of consumption behind the scenes, there still remains the problem of integrability; (*c*) all of the problems raised in connection with the order of consumption arise just as essentially in the two-variable case where there is no problem of integrability[1]; (*d*) there is the realistic possibility that the approach

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[1] Thus, in G. C. Evans: *op. cit.*, p. 121, the example of the carpenter who is not indifferent as to the order in which he renders services, receives wages, and consumes commodities would make as much (or little) sense if formulated in terms of two variables instead of three. On p. 120, this same author adds a new confusion: the path along which the line integral between two points is evaluated is called the path along which [market] *exchanges* take place.

to equilibrium may alter the final equilibrium point reached, because of irreversible *hysteresis* effects; but again, this has nothing to do with the integrability problem.

(2) The second main argument for non-integrability involves the question of whether an individual may be able to form preferences in connection with so-called " small changes " even though he is incapable of making consistent choice judgments about far-away situations. There is indeed an air of realism about this observation, but as far as integrability is concerned this is also a complete red herring based upon logical confusion—at least such is my personal judgment after a careful re-reading of all the relevant literature. It is true that one cannot accurately predict how he would spend his income quantitatively if he became fabulously wealthy or extremely poor; but the same would no doubt still be true if he consumed only two goods, and here the problem of integrability cannot arise.[1]

The most devastating weakness in this view is its failure to mean by *small* what the mathematician should mean by small in this context—namely, *finite* movements not greater than some specifiable amounts. The instant the movements become finite, however small, the integrability conditions (which are themselves of a " local character ") must become applicable or we cannot speak of local preferences at all. If we try to get out of this dilemma by interpreting small to mean infinitesimally small in a rigorously defined sense, then the argument loses all its flavour of empirical realism.

I conclude this second issue by adding two red herrings of my own: (a) Georgescu-Roegen, Weber-Fechner, and others tell us that there is a " threshold effect " of perception which surrounds every situation in much the same way that static friction follows a particle on a rough table; as Wicksell and others have recognised, this means that it is precisely for very *small* changes that the individual *cannot* have consistent preferences. (*b*) Since in the real as compared to the idealised world, all goods are ultimately not divisible beyond certain quanta, what happens to the non-integrability argument based upon the rigorous interpretation of infinitesimals ? Leaving all levity aside, I must agree that it is only realistic, in the two-good or *n*-good case, to distinguish with Marshall between short-run and long-run preference behaviour—and for that matter between *ex ante* conjecture behaviour and *ex post* actual behaviour.

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[1] With hesitation, I question the opinions on this point of two such distinguished authorities as G. C. Evans and R. G. D. Allen. The former (*loc. cit.*) speaks of " infinitesimal loci of indifference " (p. 119) and of " small changes $dx_1, \ldots dx_n$ . . . being made " (p. 122), and of an " approximate value function for small changes [which cannot, without extra assumptions, be extended] . . . beyond a merely local field ". In the cited 1937 publication, Allen assumes " that the individual has a scale of preferences for small changes from a given set of purchases . . . but this assumption . . . . does *not* imply that a complete scale of preferences exists. The consumer . . . need not be able to discriminate between widely different sets of purchases " (pp. 440–1).

(*c*) There is the argument used ever since the time of Fisher, that *non-integrability* is the more *general* case of which integrable utility is but a *special* case. Since I have myself in the past stressed this point, I should like to make clear the sense in which I now think it valid. Generality pursued too avidly leads to emptiness. As scientists we must be willing to live dangerously. What we must seek is no inadmissible specialisations and no unnecessary generality. Newton did well to speak of the " inverse-square law of gravitation " rather than the " n^{th}-power law " ; at the same time, modern physicists do well to modify his law in the field of high-speed particles in favour of the more general Einstein relativity transformations.

As I now look at the matter, why should a Gustav, who has no mind to make up, so to speak, be expected not to be changing his demand behaviour constantly and capriciously ? In other words, where a man does not exhibit the behaviouristic traces of Jeremy-like consistent ordinal preferences, why should his demand have any *time invariance* ?

At least two answers might be given to this implicit defence of integrability as the only interesting hypothesis worth making. First, a man might display consistent demand behaviour through habit or crude rules-of-thumb *not consistent with an ordinal preference field.* Second, what is *a* man ? Or *a* consumer ? I am not so much concerned with the problem of Dr. Jekyll and Mr. Hyde, but with the problem of Dr. Jekyll and Mrs. Jekyll. Much consumption behaviour is *family* rather than *individual* behaviour. Now a family must be quite sophisticated indeed to end up with a consistent set of *collective* preferences : e.g., if they set up the rule that the wife will always spend 99 per cent (or 50 per cent.) of the income on her needs and the husband 1 per cent. (or 50 per cent.) on his quite different needs, this will *not* be consistent with an integrable set of price-ratio elements. Only if the family acts in terms of a Bergson Social Welfare Function will this condition result. But to explain this farther would take me into the frontier of research in welfare economics.[1]

(4) A last argument might be built up against non-integrability: if people lack the consistency of behaviour that integrability implies, then that attractive branch of individualistic welfare economics which says people's tastes should count loses most of its content; hence, we should rule out non-integrability. I am afraid that this is an illegitimate intrusion of wishful thinking by the would-be political philosopher into the facts of life. If people do not behave as if it matters to them just what they consume, that is a weakness (but not necessarily a fatal one) for the Pareto-type compensationist new-welfare economics.[2] We must not bias our view of the facts to fit our wishes and prejudices, however pretty their pattern. On the other hand if integrability should turn out to be the best hypothesis to explain the empirical facts of the market-place, this makes a belief in individualistic ethics possible but still not mandatory. In the last analysis the definition of a welfare function is not an empirical problem.

In this connection it is interesting to note that Professor D. H. Robertson has put forward in his recent presidential address the view that Pareto and subsequent theorists were led through their fancy for fancy methods into a fanciful wild-goose chase in which they dethroned utility by the verbal act of giving new names to old terms—but that in recent years, Hicks and other devotees of the black arts of mathematical economics have completed the cycle and substantially returned to the common-sense orthodox utility views held all along (in quiet) by cooler heads, according to which utility is needed for welfare economics. I am not confident that I have correctly interpreted Robertson's meaning since his remarks were necessarily brief and purposely couched in charming ellipsis. But on the assumption that this is close to his intended meaning and that this one-fifth of his address was intended to be taken seriously, I must record some personal puzzlement.

In re-reading the cited thirty-odd basic papers of the last 60 years, I have not been able to discern trends of development along the lines of the propounded thesis. Nor am I aware that Hicks has anywhere in print reverted to a pre-Paretian position on utility; on the contrary, in 1939 Hicks independently arrived at an almost too-Paretian view of welfare economics. And other modern theorists (such as Lange, who once expressed the view that cardinal utility was unnecessary for demand studies but needed for welfare economics) were easily converted by Professor Bergson to the view that only ordinal comparisons are relevant.

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[1] Cf. *Foundations of Economic Analysis* (1947), Ch. 8.

[2] See *Foundations*, pp. 219–28.

However, Robertson can be interpreted to mean that the quest by Pareto and later writers for *non-integrable utility* was both factually unnecessary and destructive to much in welfare economics. Such a viewpoint on this more specialised and technical matter has its merits, and the present paper has the humble purpose of clarifying some of the issues.

We have now completed our main task. We know what it is that integrability implies, and what non-integrability implies: we know the full empirical implications on the demand functions of being a Jeremy or a Gustav. Deductive analysis can carry us no farther. Observation of reality must be the decisive test as to which hypothesis is the more fruitful—or whether neither is very fruitful.

MATHEMATICAL NOTES ON INTEGRABILITY

1. The observable n demand functions are assumed to be single-valued and continuously differentiable in terms of prices and income, of the form $x_k = D^k(p_1, p_2, \dots, p_n, I)$. Changing all prices and income in the same proportion will, by hypothesis, cause no change in real quantities; in consequence of this assumption of homogeneity of order zero, Euler's theorem tells us that the matrix $[D^k_j + D^j D^k_I]$ has a zero determinant—it being understood that subscripts stand for differentiation so that $D^k_j = \partial x_k / \partial p_j$, etc.

I now make the special additional hypothesis that these demand functions are *reversible* and can be inverted to express relative prices in terms of quantities. This will be assured in any local region around a point where the determinant of $[D^k{}_j]$ is not zero. A symmetrical representation of relative prices could be provided by defining new variables $(Q_1, \ldots, Q_n) = (p_1/I, \ldots, p_n/I)$. But it is more traditional to set the price of some *numéraire* good, say x_n, as 1, and to express income and all prices in terms of the n^{th} price; hence, I define $[B_1, \ldots, B_{n-1}, 1] = [p_1/p_n, \ldots, p_{n-1}/p_n, 1]$, and after reversing our demand functions, we have the *observable price-ratio functions* (or marginal rates of substitution)

$$(1) \qquad B_k = B^k(x_1, x_2, \ldots, x_n) \qquad (k = 1, 2, \ldots, n-1)$$

A similar function exists for I/p_n, which we might call $B_n = + B_1 x_1 + \ldots + B_{n-1} x_{n-1} + x_n$ after noting that there is no need to waste this symbol on p_n/p_n.

Our reversibility hypothesis can be expressed in terms of the Jacobian of the B's being non-zero. Specifically, let us define the matrix $\mathcal{J}_n$ to be the square matrix that results when we set $p_n = 1$ and exclude the n^{th} price-column from $[D^k{}_j ;\ D^k{}_I]$. Then the interested reader can verify the following partitioned matrix identities.

$$(2) \qquad \mathcal{J}_n{}^{-1} = [B^k{}_j] = \begin{bmatrix} B^k{}_j, & B^k{}_n \\ B^n{}_j, & B^n{}_n \end{bmatrix}$$

$$= \begin{bmatrix} I, & 0 \\ x_j, & 1 \end{bmatrix} \begin{bmatrix} B^k{}_j, & B^k{}_n \\ B^j, & 1 \end{bmatrix}$$

$$= \begin{bmatrix} I, & 0 \\ x_j, & 1 \end{bmatrix} \begin{bmatrix} B^k{}_j - B^j B^k{}_n, & B^k{}_n \\ 0, & 1 \end{bmatrix} \begin{bmatrix} I, & 0 \\ B_j, & 1 \end{bmatrix}$$

where I has 1's in its diagonals and 0's elsewhere and where the upper left-hand sub-matrix is always $(n-1)$ by $(n-1)$.

It is sufficient for reversibility in some small region around an observed point that the determinants of any one of these matrix products be non-zero. If we wish the B's to be reversible even when we hold some subset of x's constant, then the principal minors derived by striking out some of the first $(n-1)$ rows and columns must also be non-zero. The non-vanishing of all these principal minors throughout an extended domain will assure reversibility of our functions —not just locally—but throughout that domain.

2. So far nothing has been said about integrability conditions. Slutsky proved that if there does exist an integrable utility function $U = F[V(x_1, \ldots, x_n)]$ so that the B's can be written as the ratio of U_k/U_n, then the matrix

$$S = [s_{kj}] = \begin{bmatrix} D^k{}_j + D^j D^k{}_I\,, & D^k{}_n + D^n D^k{}_I \\ D^n{}_j + D^j D^n{}_I\,, & D^n{}_n + D^n D^n{}_I \end{bmatrix} = \begin{bmatrix} S_n\,, & s_{kn} \\ s_{nj}\,, & s_{nn} \end{bmatrix}$$

is *symmetric*, in consequence of the symmetry of the cross-derivatives, $U_{kj} = U_{jk}$. This is a singular matrix in virtue of the Euler-theorem relation $Sp = 0$; hence, the Slutsky integrability conditions involve only $(n-1)(n-2)/2$ *independent* conditions: e.g., the symmetry of the upper-left matrix, S_n, implies full symmetry.

Slutsky also showed that the elements of S are observable empirical invariant quantities, not dependent on the form of the arbitrary numerical indexes of utility. He interpreted the elements of S as *compensated* changes, for which ordinal utility is constant because the change in price is just offset by a change in money income. Slutsky showed that the diagonal or " own-elasticity " elements of S must be negative; the off-diagonal elements provide the Slutsky-Schultz-Hicks definition of complementarity, which is of greatest qualitative richness only in the $n > 2$ case. It may be added that $-S$ is positive semi-definite, being of rank $n-1$, and with its principal minors being all positive. S constitutes the most important part of consumption theory.

Not only are the Slutsky integrability conditions necessary, they can be shown as well to be *sufficient* to insure integrability. By somewhat tedious manipulation, we can show that

$$\text{(3)} \qquad \begin{bmatrix} s_{kj} & D^k{}_n \\ s_{nj} & D^n{}_n \end{bmatrix} = J_n \begin{bmatrix} I & 0 \\ x_j & 1 \end{bmatrix} \text{ or from (2)}$$

$$= \begin{bmatrix} I & 0 \\ B^j & 1 \end{bmatrix}^{-1} \begin{bmatrix} B^k{}_j - B^j B^k{}_n\,, & B^k{}_n \\ 0\,, & 1 \end{bmatrix}^{-1}$$

$$= \begin{bmatrix} [B^k{}_j - B^j B^k{}_n]^{-1}\,, & Y_k \\ Z_j\,, & W \end{bmatrix}$$

where it is unnecessary to write out the expressions for the W, Y and Z's.

If the Slutsky sub-matrix S_n is symmetric, then $[B^k{}_j - B^j B^k{}_n]^{-1}$ and $[B^k{}_j - B^j B^k{}_n]$ are symmetric. The symmetry of the last-written matrix we might call the Antonelli-Hicks-Allen conditions, since the former announced them in 1886 and the last two gave an interpretation of them in terms of symmetry of the Hicks-Allen (1934) defined measures of complementarity.[1]

3. These last conditions can now be related to the mathematicians' discussion of integrability. We associate with (1) the *partial differential equations*

$$-\frac{\partial x_n}{\partial x_j} = B^j(x_1, \ldots, x_n) \quad (j = 1, 2, \ldots, n-1),$$

and the *total differential equation*

$$B^1 dx_1 + B^2 dx_2 + \ldots + B^{n-1} dx_{n-1} + 1 dx_n = 0.$$

Any path in space along which the latter is satisfied might be termed an "indifference path", but with emphasis on the quotation marks; along such a path, we can replace the B's by any set of proportional functions

$$Q^1 dx_1 + Q^2 dx_2 + \ldots + Q^{n-1} dx_{n-1} + Q^n dx_n = 0$$

where Q^n is an arbitrary non-vanishing function and $Q^j = B^j Q^n$.

An expression like $\Sigma Q^k\, dx_k$ may be satisfactory as a *local* measure of preference, being positive when a "better" move is being made, being zero when there is "indifference", and negative when a "worse" move is being made. But its integral along any finite path between two points will *generally not* provide a consistent numerical indicator of ordinal preference—even if such a consistent preference field exists, and certainly not if such a field does not exist. Only if $\Sigma Q^k dx_k = dQ$, an *exact differential* with $Q^k = \partial Q/\partial x_k = Q_k$ and $Q_{kj} = Q_{jk}$, will such an integral be *always* the same for *different* paths between two specified end-points; and only in this case can we be sure that if we go from point A to point B by one path and return back to A by another path, the value of the integral will none the less be zero over the round trip, indicating that A is exactly as good as itself and not better.[2]

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[1] In 1939 Hicks seems to have abandoned this definition in favour of the Slutsky-Schultz definitions. For $n = 3$, the results of either definition are *qualitatively* the same. For $n > 3$, this is not true. If we define all but the two goods in question to be a Hicksian composite commodity, then the Slutsky-Hicks definition can be cast in Hicks-Allen terminology. From this the specialist will gather that I no longer think that earlier criticisms of logical inconsistency between the text and appendix of *Value and Capital* are valid.

[2] The line-integral $\int \Sigma Q^k dx_k$ along a path between two points a and b is defined as the simple integral $\int [\Sigma Q^k (dx_k/dt)]\, dt$ where $x_k = x_k(t)$ is the equation of the path, and where the appropriate limits for t are understood. See, for example, E. B. Wilson: *Advanced Calculus*, Ch. XI and also Ch. X on partial differential equations.

The above condition on the cross-derivatives will rarely be met; but we can ask whether there is not some other set of functions proportional to the B's for which we do get an exact differential. For this to exist, we must be able to find a so-called integrating factor $i(x_1 x_2, \ldots, x_n)$ such that

$$iQ^1 dx_1 + \ldots + iQ^n dx_n = dV \text{ an exact differential.}$$

This is possible only if $V_{kj} = V_{jk}$, or if we have $n(n-1)/2$ conditions

$$(4) \qquad 0 = \frac{\partial(iQ^k)}{\partial x_j} - \frac{\partial(iQ^j)}{\partial x_k} = i_j Q^k - i_k Q^j + i(Q^k{}_j - Q^j{}_k) \qquad j \neq k.$$

When we examine these conditions, they are seen not to be all independent. Also they are not conditions on the Q's alone but involve i and its partial derivatives, where i is a function not even known to exist. For any triplet of variables, say j, k, r, we can eliminate i and its derivatives by algebraic manipulation, to get the following relations on the Q's alone

$$(4)' \qquad 0 = Q^k(Q^j{}_r - Q^r{}_j) + Q^j(Q^r{}_k - Q^k{}_r) + Q^r(Q^k{}_j - Q^j{}_k) \qquad , j \neq k \neq r \neq j.$$

When $n = 2$, there are no integrability conditions; when $n = 3$, there is 1; when $n = 4$, we can write down 4 such conditions; and, in general, $n(n-1)(n-2)/6$ equations. But these are easily seen not to be all independent; at most $(n-1)(n-2)/2$ are independent and all the rest follow by algebraic manipulation.

A convenient way to get a set of independent conditions is to hold $r = n$, and work with $B^k = Q_k/Q_n$. Equation (4)′ then becomes

$$(4)'' \qquad B^k{}_j - B^j B^k{}_n = B^j{}_k - B^k B^j{}_n. \qquad n > k \neq j < n.$$

But these are the Antonelli integrability conditions, already shown to be equivalent to the Slutsky symmetry conditions.[1]

4. It has been fairly easy to show that the above conditions are *necessary* if there is to be a family of integrable surfaces. They are also *sufficient* to guarantee the existence of such surfaces; but this is not so easy to show. We may, of course, always accept the guarantee of the pure mathematician that there is a general *existence theorem* on partial

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[1] Jevons, Walras, and Marshall did not have to be concerned with the integrability problem primarily because they implicitly assumed it away, and because they assumed that the marginal utility of any good depends on its own quantity alone. In this case (4), (4)′, (4)″ are always satisfied.

differential equations assuring us that the above equations do define a family of integrating factors, i.

However, it may add to our intuitive grasp of the problem if I hastily sketch a method of actually constructing a single indifference surface. Let us start from any given point $(x_1{}^0, x_2{}^0, \ldots, x_n{}^0)$. Let us now make all but the last variable (x_n or x_3 as the case may be) move in a fixed ratio to moves in x_1; as we move x_1 from our beginning point, then $x_2 \ldots$ will move in this determined fashion; and now we require the last variable, x_n, to move as determined by

$$B^1 dx_1 + B^2 dx_2 + \ldots + 1 dx_n = 0$$

where

$$(x_k - x_k{}^0) = y_k(x_1 - x_1{}^0) \text{ or } X_k = y_k X_1 \quad (k = 2, \ldots, n-1)$$

and where the y's are arbitrary proportionality constants.

In the three-dimensional case, we are swinging a vertical door whose vertical axis of hinging goes through the original point. When the door is at any angle, there is on its surface a unique "indifference" contour through the original point. If now we let the door swing through all angles, these indifference contours will sweep out a two-dimensional surface.

Analytically, for given y's, we can eliminate all the x's but x_1 and x_n, and end up with a differential equation for x_1 and x_n. This equation always has one solution through the initial point which we may write as follows

$$X_n = g(X_1;\ y_2, \ldots, y_{n-1})$$

where the y's are parameters. Now if we let the y's vary and recall the relation $X_k = y_k X_1$, we have defined a hypersurface

$$X_n = g(X_1;\ X_2/X_1, \ldots, X_{n-1}/X_1) \tag{5}$$

which of course goes through the original point and can be written in terms of the original small x's.

But will *any* movement along this relation satisfy $B^1 dx_1 + \ldots + dx_n = 0$? By tedious substitution, we find that the answer is generally *no*—unless the integrability conditions are satisfied, in which case the answer happens to be *yes*. Only in this case can we term our surface an *indifference* surface; and only in this case shall we arrive back at the same surface if we repeat the process starting out from any other point satisfying (5). For a description of this process, called Mayer's method, see any mathematical text such as Wilson's *Advanced Calculus*, *loc. cit.*

5. By similar reasoning, we can show that if the integrability conditions are *not* satisfied, there will always be "open cycles" as shown in Figure 4. Suppose the indifference movements there described, such as from A to B, always lie on a definite surface which can have but one value for x_n in terms of the other x's. Call this surface

$$x_n = G(x_1, x_2, \ldots, x_{n-1})$$

where of course

$$-\frac{\partial G}{\partial x_k} = B^k[x_1, x_2, \ldots, G(x_1, x_2, \ldots x_{n-1})].$$

Then

$$-dx_n = B^1[x_1, x_2, \ldots, G]dx_1 + B^2[x_1, x_2, \ldots, G]dx_2 + \ldots$$

would have to be an exact differential in $(x_1, \ldots, x_{n-1})$; hence, it is necessary that the cross-relations hold

$$(4)'' \qquad {B^k}_j + {B^k}_n G_j = {B^k}_j - {B^k}_n B^j = {B^j}_k - {B^j}_n B^k = {B^j}_k + {B^j}_n G_k.$$

If these integrability conditions were not satisfied, we should have a contradiction to our assumption of an exact differential defining a surface yielding only closed cycles.

6. The Georgescu-Roegen demonstration that the contours on the budget-line planes of 3b and 3c are ellipses in the integrable case and spirals in the non-integrable case proceeds as follows. Setting all the x's constant but x_1, x_2, and x_3 or more generally x_n, then our budget plane is defined by

$$B_1{}^0 x_1 + B_2{}^0 x_2 + x_n = \text{constant} = C$$
$$B_1{}^0 dx_1 + B_2{}^0 dx_2 + dx_n = 0$$

where $B_k{}^0$ stands for the given constant prices; at the optimum point $(x_1{}^0, x_2{}^0, \ldots, x_n{}^0)$, of course, $B_k{}^0 = B^k(x_1{}^0, \ldots, x_n{}^0)$. The "indifference" contours on the budget plane must, after substitution, satisfy

$$B^1(x_1, \ldots, C - B_1{}^0 x_1 - B_2{}^0 x_2)dx_1 + B^2(x_1, \ldots, C - B_1{}^0 x_1 - B_2{}^0 x_2) - B_1{}^0 dx_1 - B_2{}^0 dx_2 = 0$$

or $$W^1(X_1, X_2)dX_1 + W^2(X_1, X_2)dx_2 = 0$$

where $X_k = x_k - x_k{}^0$, $W^k(x_1 - x_1{}^0, x_2 - x_2{}^0) = B^k(x_1, \ldots, C - B_1{}^0 x_1 - B_2{}^0 x_2)$

$$W^k{}_j = \frac{\partial W^k(0, 0)}{\partial x_j} = {B^k}_j - {B^k}_n B_j{}^0 = {B^k}_j - {B^k}_n B^j, \qquad (j, k = 1, 2)$$

where it is understood that all partial derivatives are to be evaluated at the equilibrium point.

In the neighbourhood of the equilibrium point, the slope of the contour is determined by

$$(6) \qquad (W^1{}_1X_1 + W^1{}_2X_2 + \ldots)dX_1 + (W^2{}_1X_1 + W^2{}_2X^2 + \ldots)\,dX_2 = 0$$

with higher powers of the X's neglected. If $W^1{}_2 = W^2{}_1$, which in terms of the B's expresses our old integrability condition, this is an exact differential as it stands; we immediately verify that

$$W^1{}_1(X_1)^2 + 2W^1{}_2(X_1X_2) + W^2{}_2(X_2)^2 = \text{constant}$$

represents the contours of the budget plane. If the 2 by 2 determinant of $[W^k{}_j]$, which is essentially a principal minor in equation (2), is positive, we have concentric closed ellipses surrounding an extremum or *vortex point* as in Figure 3b. If the determinant is negative, we have a family of hyperbolæ surrounding a *saddle point*. If ordinal utility is at a maximum, the last case is ruled out.

If $W^1{}_2 \neq W^2{}_1$, then we shall have an infinite number of contours running into the singular point. If the above determinant is positive and the asymmetry limited in amount so as to satisfy the Allen (1937) generalised law of diminishing marginal rate of substitution, or my weak axiom, then

$$(7) \quad 0 > \sum_1^{n-1} dB^k dx_k \quad \text{along} \quad \sum_1^{n-1} B^k dx_k + dx_n = 0$$

and we shall have a *spiral point* as shown in Figure 3c. Another less interesting possibility will be a *nodal point* in which *all* the contours, orthogonal to the above case, run into the singular point from one or two directions. All of these cases are determined by the nature of the two roots of the characteristic equation of the W determinant, $m^2 + (W^1{}_2 - W^2{}_1)m + |W| = 0$. The economically interesting cases are when the middle term vanishes so as to yield pure imaginary roots, or does not vanish so as to yield complex numbers; the real parts of the latter serve to damp down the closed elliptical sinusoidal motions into converging spirals. See L. Ford: *Differential Equations*, pp. 48–52.

7. There remains the troublesome question of what are the appropriate curvature (often miscalled "stability") conditions to be assumed in the non-integrable case. In the integrable case where the consumer is at an interior

maximum point with the x's continuous and reversible functions of relative prices and income, the matrix

$$-[W^k{}_j] = -[B^k{}_j - B^k{}_n B^j] = -\left[\frac{\partial^2 x_n}{\partial x_j \partial x_k}\right] \text{ comp.}$$

must be positive definite, which in terms of (2) implies

$$(8) \qquad \begin{vmatrix} -B^1{}_1 & -B^1{}_3 \\ -B^1 & -1 \end{vmatrix} > 0, \quad \begin{vmatrix} -B^1{}_1 & -B^1{}_2 & -B^1{}_3 \\ -B^2{}_1 & -B^2{}_2 & -B^2{}_3 \\ -B^1 & -B^2 & -1 \end{vmatrix} > 0, \text{ etc.}$$

But when $W^k{}_j \neq W^j{}_k$, these last conditions are *not* equivalent to $-[W^k{}_j]$ being the coeficients of a positive definite quadratic form with

$$(9) \qquad -W^1{}_1 > 0, \quad \begin{vmatrix} -W^1{}_1 & -\dfrac{W^1{}_2 + W^2{}_1}{2} \\ -\dfrac{W^2{}_1 + W^1{}_2}{2} & -W^2{}_2 \end{vmatrix} > 0, \text{ etc.}$$

This was shown by Georgescu-Roegen, and in 1937 Allen pointed out how his 1934 conditions (8) should be strengthened to make (9) hold in the asymmetric case. Allen obviously prefers (9) to (8), because he postulates the generalised law of diminishing marginal rate of substitution indicated a few paragraphs ago.

But *why* should such a law hold for a Gustav who has no consistent scale of tastes? Allen's argument seems to be postulational rather than persuasive, its only intuitive plausibility residing in the case of the integrable Jeremy. If all we demand is reversibility of demand—and I myself do not even demand that—then it is not clear but that the less "fully-developed" 1934 conditions are better than the 1937 conditions, even though the 1934 conditions are not invariant under linear commodity transformations.[1]

I am also a little puzzled by Wold's Theorem X, *op. cit.*, III, pp. 78–88. When this was cited in Mr. Houthakker's footnote as demonstrating that the assumptions of (1) homogeneous and (2) reversible demand functions were inconsistent with (3) non-integrability, I was aghast and ran to read Wold's paper—for such a result seemed miraculous. Interpreted literally, that theorem does seem to say that (1), (2), and (3) are "self-contradictory". But this reading may arise from the English wording of the Swedish, for it is my interpretation from the proof that Wold really means to say that any *consumer* who obeys (1), (2), and (3) is behaving in a " self-contradictory " fashion from the standpoint of consistent ordinal preference. This is completely in line with what we should expect from non-integrability. When a scientist assumes (1), (2), and (3) it is not implied that *he* is being " self-contradictory ". I hope and trust that Wold and I would be in agreement that *reversibility as such* has nothing essential to do with *integrability*.

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[1] Cf. Allen (1937), p. 516, with Allen (1934), p. 203. Even in the integrable case, I do not regard the usually assumed curvature conditions to be necessary nor do the arguments by which they are derived seem completely plausible. Cf. *Value and Capital*, p. 23.

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Uniform Cost Accounting—A Survey

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PART II[1]

UNIFORM COSTING'S OBJECTIVES

In the first part of this article, an attempt was made to give some idea of what uniform costing is. We can now turn to a consideration of its objectives, of the social consequences of achieving these objectives, and of how far its actual achievements fall short of its aspirations.

The objectives of uniform costing can be summarised under four heads. They are:

(1) To improve each firm's knowledge of its own costs so that it can

(a) seek out sources of inefficiency and waste, and

(b) base its prices on true cost information rather than on mere conjecture.

(2) To provide a uniform basis of price fixing as between firms, and so to eliminate competition based on imaginary cost differences.

(3) By facilitating an exchange of cost information within the industry, to improve each firm's knowledge of its competitors' costs, so that each producer will be stimulated to effect economies by profiting from the experience of the most efficient.

(4) To facilitate enquiry into specific cost problems of the industry. The enquiries may be carried out by, say, a Research Association with a view to ascertaining which of two methods of production is more efficient: or they may be made by a Trade Association to provide a factual basis for negotiation with a Government department. This is to say nothing of the use of standardised accounting as an instrument of control in a planned economy such as Nazi Germany.

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[1] For Part I see *Economica*, August 1950, pp. 237—253.

Many other claims have been made for uniform costing from time to time, but they are usually little more than variants on the four points set out above. Let us now subject these to closer examination.

The first claim mentioned is, in effect, that the spread of uniform costing means the spread of good costing, and that this is in itself a good thing. The discussion of uniform costing within trade association circles helps to make member firms cost-conscious: and the preparation of a single system for the whole industry represents an important "external economy" which substantially reduces the cost of costing for each firm. There is, therefore, an increase in the demand for costing and a reduction in its price, a combination of circumstances which can usually be relied upon to result in an increase in consumption of the service in question.

It is, of course, impossible to prove or disprove that the uniform costing movement has resulted in a wider recourse to cost accounting than there would have been without it. Evidence has already been adduced which suggests that progress in this direction has been less impressive than is commonly supposed, and that in some cases uniform schemes have been short-lived and have left little mark on the industries which sponsored them. Nor is it at all self-evident that the Heavy Clothing Working Party is right in thinking that, as the result of the work of some central body, "the best [costing] system would be brought within the means of every member". The essence of a uniform costing system is, after all, that it should be widely adopted. It must therefore be kept within the reach of those firms who are worst equipped and staffed to handle complex records. The industry is liable to have to go at the pace of the slowest, and the firms with advanced or novel methods of cost ascertainment and cost control are at least as likely to be held back by a uniform scheme as are those with more rudimentary costing systems to be helped forward. It is no answer to this charge to say that the uniform scheme is a minimum scheme which does not preclude elaborations or developments of it, for such a contention is not generally true. For instance, firms which might wish to adopt standard costing methods, by which costs are analysed by processes and functions rather than by products, would certainly find such methods incompatible with a uniform costing system designed to give continuous information about "actual" product costs. Again, a firm which desired its costing system to give information about incremental costs would be hard put to it to extract such information from a uniform system which was designed, as most existing systems are, to provide figures of average total cost per unit of product. One result of these conflicts may be that, where the uniform costing scheme is the basis on which a trade association collects and circulates cost statistics, member firms who wish to continue to support the scheme, but who also want cost information of a kind different from that provided by the uniform system, are driven to keep two sets of records or at least to prepare two sets of cost statements, one set to meet the requirements of the trade association, the other giving the information which they require for their own purposes.

Again, there is a danger that, a uniform scheme having once been adopted as the "one best scheme" for the industry, its very existence will encourage resistance to change. Uniform schemes are often revised in detail, but it is unusual for a new edition to embody any fundamental departure from the original scheme. Thus each scheme tends to crystallise the state of costing practice which existed when it was first devised. It is noteworthy, for example, that no British scheme published before 1936 introduces cost standards as an integral part of the system.

Turning now to the problem of competitive price fixing, there are two distinct but related aspects of uniform costing which need to be considered. One of these is concerned with providing the entrepreneur with accurate information about his costs so that prices can be rationally based. This is generally agreed to be desirable. But one need not therefore agree with the Rubber Proofed Clothing Working Party when it argues that one advantage of systematic cost accounting is that "no individual manufacturer can damage the whole trade by engaging in uneconomic trading". Such a statement is, of course, not true if, as seems likely from the context, "uneconomic trading" here means selling below average total cost, for such a phenomenon will certainly be possible and may be advisable, whatever costing system is being operated. A good system, in fact, will emphasise the distinction between those costs which tend to be fixed and those most likely to be variable with changes in output and so will facilitate selling at less than "full cost" where this is justified by the state of the market.

The other contribution which uniform costing is said to make to the elimination of "unhealthy" competition is not so much that it provides entrepreneurs with an *accurate* basis for price fixing as that it provides them with a *uniform* basis for it. The point has often been illustrated by some such example as the following. Two producers, A and B, each produce hooks and screws. A charges the two products with overheads by adding a percentage on prime cost. B charges overheads by adding a percentage of direct labour cost. The costings of the two products, when prepared, look like this (the figures, of course, are quite fictitious):

		Producer A		*Producer B*
		£		£
Hooks (per cwt.)				
Material		10		12
Labour		6		4
Prime Cost		16		16
Overheads	100 per cent. on prime cost	16	200 per cent. on labour	8
		£32		£24
Screws (per cwt.)				
Material		18		12
Labour		14		20
Prime Cost		32		32
Overheads	100 per cent. on prime cost	32	200 per cent. on labour	40
		£64		£72

If we assume that A and B each make 1 cwt. of each product, both producers incur total prime costs of £48 and total overheads of £48. On both products each producer's prime costs are the same. For a total expenditure of £96, each can produce 1 cwt. of hooks and 1 cwt. of screws. So far as real factors go, competitively there is nothing to choose between the two firms. Yet simply because they adopt different costing procedures, B will drive A out of the market for hooks, and A will drive B out of the market for screws, with dire results for both of them. So much, runs the argument, for un-uniform costing.

The point has been succinctly expressed in general terms by two American writers as follows: "The greatest advantage to be derived from uniform cost methods is that of ensuring a more uniform selling price. This object would be attained, even if the uniform system were not as scientific as it should be, for if errors were made through the method established, all manufacturers would at least be figuring the same way, all would be making the same mistakes, and unfair and ignorant competition would be eliminated."[1]

Now, so far from this being an argument in favour of uniform costing, it is a strong argument against it. If it is true that uniform costing can lead to the perpetuation of a system of prices based on erroneous cost information, we shall be much better off without it: for with normal competition, firms will jostle each other out of their errors. To revert to our numerical example above, we can surely expect that when Producer B finds that he is monopolising the market for hooks but is being driven out of the market for screws, he will take advantage of the opportunity to push up the price of hooks: and if he has unused equipment because of the loss of screw sales he would be foolish indeed if he preferred to leave this idle rather than accept orders for screws at some price which, while it might be less than £72, still made a useful contribution to fixed costs. And with producer A acting similarly but in reverse, their errors of price fixing would soon be eliminated. And when we add that this jockeying for position will be going on between not two but many firms, the chances of such errors persisting for long seem slight indeed—unless a uniform costing system perpetuates them for us.

In general, trade associations both in Great Britain and in the United States which have prepared uniform cost schemes have made no secret of the fact that one of their primary motives in so doing was to eliminate "uneconomic competition", by which is usually meant selling below average total cost. Some of the British schemes, for example, make the point quite explicitly. Thus, the fertiliser industry's scheme states that "lack of costs or fallacious costs may innocently cause unfair prices—either under control or under competition". In the view of the Council of Ironfoundry Associations, "the principal advantage of the adoption of uniform costing methods is the elimination of unhealthy competition in an industry due to lack of cost information or lack of comparability in the methods employed in finding the cost of individual jobs". In cotton weaving, "uniformity in the ascertainment of cost data and the application of sound principles will be vital to the industry in the future. Co-operation is imperative for price management. . . ." Mr. E. Victor Amsden, who prepared the chocolate and confectionery scheme, wrote in *The Accountant* that "in the cocoa, chocolate and confectionery industry a system was produced to encourage cost keeping of an improved kind with the idea that sound costing methods would reduce price cutting".[1] There is much other evidence of the same kind that, whether it is called "price management" or "orderly selling" or "the elimination of unhealthy competition" or the "maintenance of price stability", the prevention of price cutting is usually well to the fore in the minds of those who advocate uniform costing.

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[1] Nicholson and Rohrbach, *Cost Accounting*, p. 12; quoted by the Federal Trade Commission in their report on Open Price Trade Associations, 1929.

There is, of course, nothing inherent in uniform costing to prevent real price competition, and some trade associations have recognised this. Thus, the Wholesale Clothing Manufacturers' Federation, in the introduction to its costing scheme, says: "It should be clearly understood that the Costing System makes no attempt to fix prices. What it aims at is to enable a manufacturer to arrive at his true cost . . . if there are special circumstances which compel or influence him in selling at a lower rate of profit or even for no profit at all, the Costing System enables him to do this with his eyes open and with a full knowledge of the lowest figure which may be quoted without entailing a loss".

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[1] "Uniform Costing Systems", by E. Victor Amsden. *The Accountant*, 24th October, 1942, pp. 255–257. Mr. Amsden also prepared a uniform costing scheme in 1923 for the National Association of Master Bakers, Confectioners and Caterers.

And the Dyeing and Cleaning scheme even goes so far as to recognise that " among certain members of the Industry some apprehension may exist that the installation of costing systems will throw into bold relief the low processing cost of certain lines handled, and result in extensive price reductions to the disadvantage of the trade in general ". The fact is that a scheme designed to distinguish clearly short-run incremental costs might well stimulate price competition rather than the reverse, since it would show how far prices could safely be cut.

The effect of uniform costing is, nevertheless, usually to obscure short-run cost differences between the firms in an industry and by eliminating so-called " uneconomic " competition much of the sting is, at the same time, taken out of price competition altogether. The obscurement of cost differences is effected by concentrating attention on average total cost, which will usually be less dissimilar for different firms in the industry than will their variable costs. There are a number of reasons why this should be so. For instance, new firms will tend to be more highly mechanised than old firms. Their fixed costs will therefore probably be higher and their variable costs lower. Thus for a short period they could undercut their older rivals if they were content to cover only their variable costs : and if their fixed equipment is not fully employed and there is in the short run no alternative use to which it could be put, it would seem to be in their best interests to do so. But such action will clearly be discouraged by costing methods which focus attention on average costs, including full overhead allocations. Again, the inclusion of " imputed " costs, such as a salary to the proprietor of the business or a notional rent for premises which are owned will swell recorded costs by amounts which, for short periods, do not represent any opportunity costs at all. Few business men would not prefer to forgo their remuneration for a short period rather than give up their businesses. A building specially adapted to one purpose cannot easily or quickly be switched to another, even if it could then command a high rent. And even if it is not highly specific, in reckoning its value in another use the cost of closing down the existing business and moving ought strictly to be taken into account.

Thus by including in costs items which do not at all times for all firms represent real sacrifices of producing, uniform costing may give no more than an illusion of uniformity, and it is for this reason that at the beginning of this article I preferred not to adopt the definition of uniform costing put forward by the U.S. Chamber of Commerce. But too much should not be made of this criticism, as some American critics of uniform costing have at times tended to do. It is true, as these critics have pointed out, that there are other ways in which this sham uniformity can be induced. Thus the inclusion in costs of interest on capital employed in the business will raise the apparent costs of highly mechanised firms more than the costs of those less mechanised even though capital, once sunk in specific equipment, has no opportunity cost in the short run. Again, some firms may produce a commodity as a by-product, while others produce it as a main product. This implies real cost differences as between the two types of producers. These differences can be seemingly eliminated by some arbitrary method of allocating costs to by-products. It is easy to multiply methods like these by which costs which may really be different can be made to look the same. In fairness it must be said, however, that many of these methods are seldom found in practice. Of the British schemes which have been examined, few do in fact advocate the inclusion of interest in costs, and none attempts to allocate costs (other than post-separation costs) to by-products. In the United States, too, " there is . . . by no means a wide acceptance of the proposition that interest is properly chargeable to cost. . . ."[1] Moreover, in the last resort, firms which are not prepared to give up their short-run competitive advantages by adopting the cost methods just described will simply not adhere to the system laid down for their industry. This, perhaps, more than anything else explains the insecure hold which uniform costing has on the loyalties of the members of the trade associations concerned with it.

Uniform costing has sometimes gone beyond merely recommending uniform *methods* of costing, and has laid down certain uniform *figures* and rates for adoption throughout an industry. Thus uniform rates of depreciation may be recommended. A uniform percentage of capacity usage may be laid down for adoption as a base for spreading overheads. These rates and percentages naturally do not always correspond to every firm's own experience. The substitution of uniform data for each firm's own is only a first step. It may be followed by the substitution of uniform " costing rates " for each producer's own costs. It is then only a short step to the adoption of uniform profit loadings and eventually to the enforcement of agreed selling prices throughout the industry.

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[1] *T.N.E.C.*, Monograph No. 18, p. 262.

Again, it would be wrong to tar uniform costing too freely with this brush. In Great Britain uniform costing rates are not common, and where put forward by a trade association they are intended for use only by firms which have no system of their own (uniform or otherwise) for ascertaining costs. Thus the British Federation of Master Printers issues a folder of Standard Hourly Cost Rates. These rates, says the folder, " are calculated from ascertained facts relating to printing offices generally. They . . . are issued for general guidance. They can, however, be used in conjunction with the Federation Costing System until figures for the individual business are ascertained by means of this system ". These costing rates, then, can be used in two ways—as a standard against which each firm can compare its own figures, and as a basis of costing by firms which have no costing systems of their own. They represent the cost per hour of printing, not the cost of doing any specified printing job. The printer is left to use his own judgment as to the amount of printing he can expect to do in an hour. It would be absurd, in the circumstances, to regard the Federation's folder as an instrument of monopolistic extortion. In other cases, such as the British iron and steel industry, uniform costing has followed rather than preceded agreed selling prices for the industry's products.[1] In America, the Hardwood Lumber and Maple Flooring Cases of 1925, brought under the Sherman Anti-Trust Law, have made trade associations circumspect about costing practices which might be interpreted as illegal agreements between producers.[2] The transformation of uniform costing into uniform pricing is a potentially dangerous development rather than a present evil. That it is, at least in Great Britain, a real danger is seen from the passage in the Linoleum Working Party's Report to the effect that uniform costing would facilitate the furnishing of

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[1] And for a reference to the pottery industry see *Economica*, Aug. 1950, p. 103.

[2] For a careful study of the legal status of uniform costing and related practices in U.S.A., see Richard H. Lovell, " Sales Below Cost Prohibitions ", *Yale Law Journal*, Vol. 57, pp. 391–425 (January 1948).

"information on costs for the purpose of fixing minimum prices". And it has yet to be seen whether No. 17 of the functions of Development Councils set out in the Schedule to the Industrial Organisation Act, 1947, the "formulation of standard costings", is a step in the same direction.

Uniform methods of cost ascertainment, in their price-fixing aspect, are, as we have seen, open to criticism. As a pre-requisite to a scheme for an exchange of cost information within an industry or trade, however, the value of uniform costing can hardly be gainsaid, though it is, of course, no more than a pre-requisite. As such, its value depends on what the trade association concerned does with it. This would be too obvious to be worth mentioning if it were not for the fact that, in Great Britain at least, it is exceptional to find a uniform costing scheme which is actually used as the basis for an exchange of cost information.

Two advantages are claimed for a dissemination of cost data among the members of a trade association. "Most cost statistics serve the dual purpose of enlivening the member's consciousness of the relation of cost to price and of stimulating his interest in the better and more economical management of his business",[1] i.e., cost statistics educate members to sell above cost, and to get costs down. The first of these functions has already been fairly fully discussed, though it should here be added that there is an additional danger, when costs are reported to a trade association, that active pressure may be brought to bear on low-cost producers not to "spoil the market". The second, or cost-cutting function, is of a much more constructive character. The pioneer work of Sir Arnold Plant and Mr. R. F. Fowler on the costs of running department stores in Great Britain is worth recalling in this connection. "The opportunity for the first time", they write, "to compare its own operating experience with the general experience of stores which it believes to be comparable provides a store with new information of definitely substantial importance. It is not that any special virtue attaches to possessing or attaining to a cost structure corresponding to that of generalised experience, but simply that, until the opportunity for such comparisons presents itself, the firm has no ordinates in relation to which it can plot the figures of its own experience".[2]

[1] *T.N.E.C.*, Monograph 18, p. 285.

[2] "The Analysis of Costs of Retail Distribution", *Economica*, May 1939.

It is clear that to be useful, the firm's comparison must be made with the costs of other firms "which it believes to be comparable". Thus to satisfy this condition at all, the cost tabulation must analyse the participating firms into groups which are homogeneous at least as to the firm's size, locality and general type of product. Then, if the product can be more accurately defined so as to ensure reasonable homogeneity (e.g., a ton of pig iron), the cost per unit of output can be compared. Otherwise, only the percentage which each item of expense bears to total cost or to turnover can usefully be studied. The smaller the number of groups into which the whole sample is divided, the less valuable the comparison will be, for the group figures become merely an average of dispersed data. Obviously, a single set of averages for the whole sample will be of very little value at all. Ideally, each firm in the sample should be listed separately, under code, together with as many data as possible, such as turnover, number of employees, and so on to indicate the kind of organisation to which the costs in question belong, stopping short, however, of actually disclosing its identity.

It is perhaps too easily taken for granted that a high-cost producer is helped to make economies by knowing what his competitors' costs are. Enquiries made of a number of trade association executives have not clearly established many instances of economies being made in this way, though there have certainly been a few. The competitive firms in an industry are perhaps not unlike the candidates in an examination. To know what one's fellow-candidates' marks are may be interesting, but it is not clear that such knowledge will be helpful in improving one's own position next time. To know the average mark of all candidates would be even less valuable. What one wants to know is how to answer the questions. So, in the industrial field, a knowledge of other people's costs will, probably, only be useful if it gives rise to discussion in trade circles of *why* cost differences exist, or if cost statistics are circulated in such great detail as to show not only where but also how savings are effected. Thus a high-cost producer will not be greatly helped by the knowledge that a competitor's costs under the heading "materials" are less than his own. But the knowledge that this saving has been effected by substituting a cheap alloy for an expensive metal may be very valuable indeed. Cost statistics seldom, if ever, give such detailed information.

When one turns to enquire what trade associations in this country have achieved in the field of cost comparisons and the dissemination of cost statistics, based on uniform costing schemes, the results are not at all impressive. Through the activities of their costing department's accountants, who periodically visit some 300 firms, the British Federation of Master Printers have accumulated a good deal of information about the average cost per £1,000 of turnover, costs per 100 square feet of space and per £100 of capital employed in the printing trade, and this information is said to be used by the accountants when advising firms as to possible economies. But it is not made generally available to the industry, or even to the firms from which the information has been gathered. The Institute of British Launderers Ltd., just before the war, did arrange for a voluntary exchange of cost information in which about 20 laundries participated. Each firm received, every four weeks, a detailed tabulation of the turnover and costs of all other participating firms (represented by code letters), turnover being given in actual money values while costs (in detail) and trading profit were shown as percentages of turnover. In addition, information was given for each firm as to the average weekly number of customers in the period and the average price per bundle, the number of employees (divided as between " productive workers " and others), the average sales value of output and average wages per productive worker per week, the average weight of fuel used per week, the number of vans, average mileage run per week and the cost per mile, the total floor space, and the total installed horse power of steam engines or electric motors. With such information the danger that wrong conclusions may be drawn from a comparison of the costs of what are, but are not known to be, very differently situated businesses is at least substantially reduced. It should be noted that this scheme did not attempt to compare product costs, i.e., the costs of laundering particular articles, but only total costs (by type of expense). Unfortunately this promising scheme of the Launderers lapsed with the outbreak of war in 1939.

In a related industry, the National Federation of Dyers and Cleaners has very recently organised a quarterly exchange of cost statistics, in which about 30 firms are at present participating. The first tabulation was made for the December 1949 quarter. It is too early to say whether this scheme is likely to command wide support in the industry.

The only other known existing scheme for exchanging cost information which is based on a uniform costing system is that organised by the Iron and Steel Federation. Data are collected separately for each of the main products (pig iron, soft basic billets, black sheets, railway rails, sheet bars, steel plates, and steel joists). For pig iron, summarised costs per ton for each producer (represented by a code letter) are circulated monthly to all members in that section of the industry, while for other sections only the average costs for all producers are circulated. This information is also made available to the Ministry of Supply and plays its part in the price-fixing arrangements for the industry.

No trace has been found of any other instances of a uniform costing scheme serving as the basis for an exchange of cost statistics within an industry in this country. Trade association officials who were asked why their own associations, which had sponsored costing schemes, did not promote such an exchange of information, usually said that firms in their industry were unwilling to make cost data available to competitors, even under code. In one case it was suggested that the information, especially so far as it related to management remuneration and profits, might be misused by the trade unions in the industry. This last suggestion perhaps throws some light on the much wider circulation of cost statistics in American industry, where trade unions take a more favourable view of profits than that common among British trade unionists.

Finally, it has been claimed, a uniform cost system may be a pre-requisite to the institution of *ad hoc* cost studies and enquiries by a trade association or similar body. On the face of it, it is here that the greatest scope exists for " external economies " in the accounting field, and for really constructive work by trade associations, perhaps in collaboration with the co-operative research associations in each industry. So far as British experience goes, however, this work has hardly started. Of interest as a pioneer effort in the field of efficiency studies is the work of Dr. L. H. C. Tippett, at the Shirley Institute, for the cotton industry.[1] It is, however, worth noting that the cotton investigations have been based on physical facts such as loom stoppages rather than on costs. There is all too little evidence that such cost data based on uniform costing as have been collected by trade associations in this country have proved to be of value even as a starting point for studies aimed at reducing costs. The amount of information which firms can be asked to provide as a matter of routine is naturally severely limited, and any particular expense heading therefore almost invariably covers what is in fact a heterogeneous collection of costs. A total of expenses grouped under some such caption as " material handling costs " is of little use to an investigator who is trying to compare the costs of mechanical handling with the costs of using wheelbarrows. Inevitably he will have to go to the individual firms for his information, and although uniformity of expense headings in different firms may make his detailed enquiries a little easier, the advantages of uniform costing, at least in its present form, in this respect can hardly be put higher than that.

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[1] For an account of Dr. Tippett's work see his article, " Study of Industrial Efficiency, with special reference to the cotton industry ", in *Journal of the Royal Statistical Society*, Vol. CX, Pt. II, 1947.

Conclusions

Uniform cost accounting has a real contribution to make to industrial efficiency, but it is not at present making that contribution. As an instrument for improving each firm's knowledge of its own costs, its achievement in making smaller firms cost-conscious has been small while larger firms may actually sometimes have been held back in their costing methods. Uniform costing may well have reduced competition by obscuring cost differences between firms, but this can hardly be accounted a virtue from the social point of view. Little has been attempted in the way of disseminating information among firms about their competitors' costs, and what has been attempted, while it may have directed thought to the possibility of cost reductions, has not clearly indicated where or how such reductions might be effected.

These shortcomings are due to a misplaced emphasis. Trade associations have unfortunately if naturally emphasised the pricing aspects of uniform costing, whereas the constructive aspects are those concerned with the raising of efficiency and the reduction of costs. The failure of uniform costing to establish itself can be traced, it may be suggested, to its attempt to be all things to all men. Cost accountants are coming to realise that no one kind of grouping of costs can serve all the needs of even a single business. Much less can it serve all the needs of a number of diverse businesses. With the recognition of this fact, and an acceptance of a more limited rôle than its exponents at present claim for it, uniform costing could justify its existence. It could do this by providing a starting point for cost studies, to be carried out perhaps by operational research sections of research associations rather than by trade associations. Such studies would aim at the development of cost-saving techniques; they could be substantially helped by a form of uniform cost accounting which was not preoccupied with price fixing. A further study, not limited like the present one to a survey and critique of British uniform costing as it exists at present, might well be devoted to the reforms necessary to bring such a state of affairs about.

The London School of Economics.

Real Investment in Stocks and "Inventory Profits" in 1948[1]

By A. P. Zentler

(The latest White Paper on "National Income and Expenditure"—Cmd. 7933 of 1950—gives, for the first time, estimates of real investment in stocks and inventory profits. This article, however, was prepared before the White Paper appeared and the arguments developed in it refer to the situation prior to the publication of official estimates. It may be mentioned that the latter are very nearly the same as the figures given below.)

1. The U.K. official estimates of national income are inclusive of inventory profits[2] or losses. It is essential, therefore, when comparing the official national income figures for different years to make adjustments for changes in the value of stocks due exclusively to price movements. These adjustments are even more important for comparisons of capital investment in various years. No published estimate of inventory profits for 1948 seems to exist[3]; nor—for that matter—are there any data on overall "changes in the value of stocks" in 1948, except the heterogeneous figures given in Table 2 of the "White Paper on National Income and Expenditure, 1946 to 1948." These figures relate to the "increase in value of stocks, work in progress and surplus stores transferred to private inventories"—item 3*b* of Table II, and to "sales of surplus stores by the Government (including amounts exported and consumed)"—item 3*c* of Table II. For reasons explained in the White Paper one cannot arrive at a figure of *net* "increase in the value of stocks" by taking 3*c* from 3*b*. In any case, the White Paper figures are residuals, and therefore liable to very large margins of error. The purpose of this paper is to provide independent estimates of

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[1] The estimates described in paras. 20, 24 and 26 are largely the work of Mrs. M. F. W. Hemming; I am also indebted to her for many valuable comments.

[2] See para. 9 for definition of inventory profits.

[3] Except for the tentative guess made in the National Income White Paper (Cmd. 7649 of 1949, p. 17).

(i) investment in physical stocks, and (ii) inventory profits in 1948. It is also hoped that the publication of this article will elicit criticism from various quarters, which will make it possible to improve the estimates given below.

2. The following two tables summarise the results obtained by methods described in the second part of this paper:

TABLE I

ESTIMATED VALUE OF STOCKS AT END OF 1948

	£ *millions*
Manufacturers' stocks	2272
Retail stocks: Food	100
Non-food	380
Wholesale stocks: Food	86
Non-food	324
Stocks of Government Trading Departments	409
National Coal Board stocks	60
British Transport Commission stocks	66
"Other" public corporation and post office stocks	142
Wool stocks	50
Farm stocks of potatoes and cereals	110
Value of livestock on farms	321
	4320

TABLE II

CHANGES IN THE VALUE OF STOCKS DURING 1948 (£ MILLIONS)

	Due to Price	*Due to Physical Change**	*Total*
Manufacturers' stocks	200	188	388
Retail stocks: Food	4	16	20
Non-food	25	−36	−11
Wholesale stocks: Food	3	15	18
Non-food	33	−33	nil
Stocks of Government Trading Departments	31	−12	19
National Coal Board stocks	6	6	12
British Transport Commission stocks	7	2	9
"Other" public corporation and post office stocks	30	−2	28
Wool stocks	9	−13	−4
Farm stocks of cereals, etc.	7	46	53
Livestock on farms	24	14	38
	379	191	570

* At av. 1948 prices.

3. It should be emphasised that the total of £570 million does not represent the *net* change in the value of stocks for the economy as a whole in 1948. In fact, it corresponds roughly to item 3*b*, Table 2 of the National Income White Paper (see para. 1 above) and excludes, therefore, Government disinvestment in the shape of sales of surplus war

stores. Total Government disinvestment of this kind was £194 million,[1] but as this total includes sales of fixed equipment (ships, vehicles, etc.) and our total of £570 million does not, a deduction has to be made from " total Government disinvestment " to account for sales of fixed equipment by the Government. It is estimated that about 35 per cent. (£69 millions) of total sales of surplus stores (in 1948) were capital goods. This leaves 125 millions worth of non-capital goods to be deducted from investment in physical stocks (£191 millions), thus reducing the " total change in the value of stocks " (£570 millions) to £445 million :

Net changes in the value of stocks during 1948 £ *million*

Due to price	*Due to physical change*	*Total*
379	66	445

4. Two general comments may be made on these net figures :

(1) However large the margins of error of the above three figures it is very likely that inventory profits in 1948 were larger than is generally believed (the National Income White Paper suggests £150 million). (2) As explained below (para. 5) the estimate of investment in physical stocks is liable to larger percentage errors than the other two figures. Nevertheless, it is fairly safe to say that *net* real investment in stocks in 1948 was small. This does not contradict the general belief that industrial and trade stocks were rising during that year. As can be seen from Table II manufacturers' stocks went up (in real terms) by nearly £200 million.

The drop in trade stocks was due entirely to heavy Christmas shopping ; in most of the remaining 11 months of 1948 retail stocks (and probably the majority of wholesale stocks) were substantially higher than in the corresponding period of the preceding year. However, not all of the comparatively heavy investment in stocks by the private sector of the economy in 1948 was drawn from current resources ; some of it came out of the stocks the Government accumulated during the war. It is this (and other) Government disinvestment which reduces the figure of investment in physical stocks for the economy as a whole to surprisingly small dimensions.

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[1] The figure given in the White Paper (Table 2, Item 3*c*) is £257 m. but I understand it will be revised (to £194 m.) when the National Income figures for 1949 are published.

5. It should be obvious from Part II that all estimates given in Tables I and II might differ appreciably from the true values. In general[1] it may be said that the figures for "total end-1948 value of stocks" (Table I) is the least likely to be wrong. The figures for changes in the value of stocks "due to price" and those "due to physical movements" (Table II) may be out a good deal. The figure for "real investment" is particularly sensitive to changes in the assumptions made about increases in prices because "inventory profits" are nearly twice as large as real investment (£379 m. compared with £192 m.—Table II); if it is assumed that prices rose less and inventory profits were, for instance, only £340 m. (*i.e.*, 10 per cent. less), real investment would be £230 m. (*i.e.*, 20 per cent. more).

6. Lastly, a plea for better statistics of stocks. There is no need to emphasise here the need for reliable information on movements in stocks, especially in an economy in which a deliberate attempt at "planning" is made. For instance, for investment planning purposes, it is necessary to know the upper limit to *fixed* investment in the year for which the plan is drawn up. This, however, can only be obtained by subtracting probable investment in stocks from the forecast of *total* investment possible in that year. It is clearly *not* possible to estimate investment in stocks in a future year if one does not know what it was in a preceding period. In the U.S., where planning does not (ostensibly) take pride of place, comprehensive statistics of stocks are available. These are based, in some cases, on quite small samples, *e.g.*, ". . . the sample of merchant wholesalers . . . includes approximately 3,000 merchant wholesalers reporting sales, and 1,800 reporting inventories. In terms of *sales*, coverage of the sample ranges from 1 to 35 per cent. of total sales for the various kinds of business groups . . ."; the results, however, are considered satisfactory.

7. In the not too distant future up-to-date information on manufacturing firms will become available from the new census of production; we should also have, for the first time, a detailed picture of the distribution system of this country

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[1] See para. 27 for details.

when the census of distribution is at last taken. It should be possible with all this information to devise small samples of manufacturers, returns from whom would provide *reliable* information on stocks.

II

8. A brief description of the methods used in estimating each category of stocks is given below. In view of the limited space available results only are given for a number of operations. However, before proceeding to this description of methodological matters it was thought useful to give a short summary of the basic problem of stocks' valuation in the present context.

9. The need to make adjustments for inventory profits or losses[1] in the official national income calculations arises from the clash between the generally accepted definition of national income[2] and the definition of profits adopted by the Inland Revenue Department for income tax purposes. What is called here the "generally accepted" concept of national income implies that profits are equal to "the difference between current receipts and the current cost of replacing all real factors of production used up in current production."[3] On this definition of profits, increases in the value of stocks between the beginning and end of the year should be included in profits only if they represent "real" investment in stocks; not if they are due to stocks being valued at higher prices at the end of the year. But the figure of profits arrived at for income tax purposes includes the whole of the change in the value of stocks, *i.e.*, real investment *plus* inventory profits or losses. This means that on the Inland Revenue definition, profits in a period of rising prices are higher than they would be if alternatively defined, and lower in a period of decreasing prices. As it is these inflated (or deflated) figures of profits which find their way into the official national income accounts, the White Paper national income estimates and the investment estimates implicit in them, have to be corrected for inventory profits or losses. Inventory profits or losses may

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[1] *i.e.*, that part of the total change in the value of stocks, which is due not to a rise (or fall) in physical stocks, but to stocks being valued at prices higher (or lower) at the end than at the beginning of the year.

[2] *i.e.*, the value of goods and services produced each year, in excess of what is required to maintain the real amount of capital assets (including stocks) intact.

[3] Meade and Stone: "The Construction of Tables of National Income, Expenditure, Savings and Investment," *Economic Journal*, 1941.

be defined more precisely as the difference between the total change in the value of stocks and the value of the change in physical stocks—the increment or decrement in physical stocks being valued at average prices for the year.

10. As business concerns are entitled to value their stocks at cost or current price, whichever is the lower, there are, altogether, four possible ways in which the " total " change in the value of stocks can be represented in the accounts of firms. Barna[1] has given algebraic expressions for these four possibilities (X, X', Y, Y'):

$$X = p_1q_1 - p_0q_0$$

$$X' = p_1q_1 - p'_0q_0$$

$$Y = p'_1q_1 - p_0q_0$$

$$Y' = p'_1q_1 - p'_0q_0$$

where q_0 and q_1 denote quantities of stocks at the beginning and the end of the year; p_0q_0 and p_1q_1 denote the current value of stocks at the same dates, while p'_0q_0 and p'_1q_1 stand for the cost of q_0 and q_1.

In view of the fact that prices were going up continuously between, say, mid-1947[2] and end-1948 and stocks were, therefore, valued " at cost " both at the beginning and end of 1948, Y' is the correct expression for the total change in the value of stocks in 1948; inventory profits then are equal to

$$(p'_1q_1 - p'_0q_0) - \frac{p_0 + p_1}{2}(q_1 - q_0)$$

where p_0 and p_1 are "actual" beginning- and end-1948 prices (*not* as defined in footnote 3, page 408).

11. There are a number of conceptual difficulties connected with the problem of inventory profits. These will not be touched upon here as they have already been discussed at great length by other writers. There is, however, one basic difficulty that is worth pointing out because it forces us to make a sweeping assumption which is not explicitly mentioned elsewhere in this paper. It is the well-known and (for various reasons) unavoidable assumption that stocks accumulate and decumulate at an even rate, throughout the period under consideration (1948 in this

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[1] " Valuation of Stocks and the National Income," *Economica*, 1942.

[2] " Mid-1947 " on the assumption that the period turnover of stocks is 6 months.

paper). The effect of an uneven rate is less marked than would appear at first sight; in fact, the results would be distorted only when changes in the accrual of stocks are correlated with changes in prices. It should be emphasised, therefore, that in 1948 the movement of prices was such that errors due to the above assumption not corresponding to the facts are likely to be small.

METHODS USED

(A) MANUFACTURERS' STOCKS

12. Following recent changes in company law, public companies have been obliged since last July to include in their annual reports figures of stocks held (*a*) on the date of the balance sheets, and (*b*) twelve months earlier. The totals for all balance sheets published in each quarter appear in the "Records and Statistics Supplement" to the *Economist*. It was assumed that each quarters' batch of balance sheets[1] is a representative sample with respect to movements in stocks. This assumption was checked in a general way by the fact that it was possible to construct (with the help of the percentage movements between 1947 and 1948 shown in the balance sheets) curves of the movements in stocks (between the beginning of 1947 and the end of 1948) which conform with independent general observations on the subject.[2] The stocks figures of companies publishing balance sheets for each quarter of 1948 were then projected backwards and forwards (according to the trend described in footnote 2) so as to obtain the value of stocks for all public companies at the end of 1947 and 1948, at current prices. The difference between

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[1] In addition to manufacturing firms the companies concerned include some entertainment undertakings, hotels and restaurants, public utilities, finance companies and shops and stores; the last category is treated separately in this paper and the remainder represented only 6 to 7 per cent. of total stocks (here discussed under the heading "manufacturers' stocks").

[2] More explicitly, a rough estimate of the trend in physical stocks between March and December, 1947, was made, based on a few known facts or on reasonable assumptions: (*a*) the drop in stocks during the fuel crisis; (*b*) the gradual recovery in the subsequent months of 1947; (*c*) the seasonal fall of stocks in December. Given the 1947 trend the movement of stocks in 1948 is determined by the relationship between each quarter of 1947 and 1948, shown by the balance sheet figures. The fact that the 1948 trend in stocks is very much what one would expect it to be is at least an indication of the representativeness of each quarterly batch of balance sheets. It should be emphasised that, given the quarter-to-quarter relationships indicated by the balance sheets, large divergencies from the 2 curves thus obtained are ruled out. If one alters any one of the four known points (March, June, September and December) substantially in, say, the 1948 curve, the 1947 curve becomes nonsensical. A further check of representativeness was obtained by re-weighting the industrial groups of the last quarter's batch of balance sheets with the average weight each group had in the four quarters of 1948. The increase in the value of stocks thus obtained differed from that based on the original weights by less than 5 per cent.

the two end-year figures gives the " increase in the value " of stocks during 1948.

13. The above estimates of (*a*) end-1947 and (*b*) end-1948 value of stocks were checked in different ways :[1]

(*a*) An approximate end-1947 value of stocks can be obtained by adding up the 8 quarterly values given in the balance sheets[2] and dividing by 2. On the assumption that there is a seasonal drop in stocks at the end of the year and that the stocks curve has an upward trend, this second estimate is very likely to be higher than the true value. The results yielded by the first method and the " check " method are respectively £1452 m. and £1550 m., which seems reasonable.

(*b*) The end-1948 value of stocks obtained by applying the balance sheet percentage increase between December, 1947 and December, 1948 (21 per cent.) to the estimated value of stocks at the end of 1947 gives practically the same figure (£1757 m.) as the first estimate of end-1948 value of stocks (£1750 m.).

A third estimate of the end-1948 value of stocks can be arrived at by assuming that the rate of increase in physical stocks between December, 1947 and December, 1948 (as shown by the balance sheet figures adjusted for the increase in prices movement) was uniform and projecting the 1948 (balance sheet) quarterly *values* of stocks accordingly. The figures thus obtained are then expressed in terms of end-1948 prices.[3] In view of the seasonal drop at the end of the year this estimate is likely to have a slight upward bias. In fact, the figure obtained, £1788 m., is not much higher than the other two estimates (£1750 and £1757 m.).

14. The split between inventory profits and the " value of the increase " in physical stocks is arrived at in three stages :

(*a*) End-1948 stocks (at end-1948 prices) are expressed in terms of end-1947 prices; the difference between end-1948 stocks at end-1947 prices and end-1947 stocks at end-1947 prices represents investment in physical stocks at end-1947 prices.

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[1] The results of the various checks discussed below are not strictly speaking independent estimates (as they are all based on the same data), but each estimate has behind it a somewhat different set of " non-proven " assumptions; the fact that the estimates are nevertheless quite close to each other strengthen's one's confidence in them.

[2] March, 1947 and 1948; June, 1947 and 1948; Sept., 1947 and 1948; Dec., 1947 and 1948.

[3] Throughout this paper end-1948 and end-1947 prices mean prices at which stocks were valued at the end of 1948 and 1947 in balance sheets—see para. 15 below for assumptions behind the price indices.

(*b*) The latter figure is then expressed in terms of average 1948 prices giving the required estimate of investment in physical stocks at average 1948 prices.

(*c*) The figure for inventory profits is simply the difference between the "total increase in the value of stocks" and the "value of the increase" in physical stocks at average 1948 prices.

15. The *price indices* used in the above computations assume that:

(i) the average period of turnover of manufacturers' stocks was six months—a rather higher figure than that given by Barna[1] in 1942 for the economy as a whole (about five months). Thus stocks at end-1947 are assumed to be valued at average price during the six previous months July-December, 1947.

(ii) (*a*) There is a lag of 4 to 7 months between the date to which a balance sheet is made up and the date on which it is published. (*b*) The majority of each quarter's balance sheets are made up to the end of the quarter. Assumption (*b*) was made partly for the sake of simplicity, partly because there is reason to believe that, by and large, companies do, in fact, make up their balance sheets to the end of quarters. Point (ii) implies that the balance sheets published between, *e.g.*, April and June are all made up to the end of the preceding year.

(iii) Manufacturers value their stocks for balance sheet purposes on the basis of "cost or current price, whichever is the lower" and "first in first out." No adjustment for "base stock valuation" was made because it is understood that such instances are very rare.

(iv) The break-down of manufacturers' stocks in this country is roughly the same as in the United States (purchased materials 40 per cent., work in progress and finished goods 60 per cent.).

16. The Board of Trade Index of Wholesale Prices of Industrial Materials and Manufactures was used for purchased

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[1] "Valuation of Stocks and National Income", *Economica*, 1942.

materials, and an arithmetic mean of this index and labour costs (*i.e.*, earnings adjusted for movements in productivity) for work in progress and finished goods. The decision to allocate equal weights to purchased materials and labour costs is based on the 1935 Census of Production figures for some of the major industries. In view of the fact that very little is known about the movements in overhead costs it was assumed that they moved in step with the average of purchased materials and labour costs.

17. As the figures so far obtained represent stocks of "public" companies only, an upward adjustment has to be made to take account of stocks of (1) private companies, (2) partnerships, etc. No information seems to exist about the relation between private and public companies, in any respect that is relevant to the problem under consideration, but a rough idea of the relative importance of "partnerships, etc." can be obtained from the gross profits figures published by Inland Revenue. On that basis "partnerships, etc." represent about 8 per cent. of all enterprises. The field covered by private companies is probably larger—say, 15 per cent.; this means that our stock figures based on the balance sheets of public companies should be increased by 30 per cent. The 15 per cent. assigned to "private" companies is, of course, a pure guess, but as there is no information whatever on this subject such a guess was unavoidable.

(B) TRADERS' STOCKS

Retail Stocks

18. Very little information exists on this subject and the estimates are therefore extremely rough. They are based on the assumption—for which there is some evidence—that in December, 1948, non-food stocks were the equivalent of, say, 10 weeks' (1948) sales, and food stocks equivalent to 1 week's. The approximate value of 1948 retail sales can be derived from the White Paper on "National Income and Expenditure" figures of consumption. To some extent the estimates of stocks can be checked by comparing the ratio between retailers' and manufacturers' stocks in this country and in the U.S. The official indices for retail prices and retail stocks were used in the calculations.

Wholesale Stocks

19. Information on wholesale stocks is even scantier than on retail stocks ; the figures put forward under this heading have therefore substantially larger margins of error than most other estimates given in this paper. The only starting point is the relation between wholesale and retail stocks in the U.S. In that country wholesalers' stocks, in 1948, were about 67 per cent. of retailers' stocks. It was assumed that in this country the corresponding percentage was 85 per cent. It is fairly certain that in the U.K. wholesale stocks form a larger proportion of total traders' stocks than in the U.S. Firstly, a good deal of export trade is probably handled by wholesalers, and export trade is much more important in this country than in the U.S. Secondly, there is evidence to show that in this country small retailers probably have an appreciably larger share of trade than in the U.S., and by and large it is they and not the large-scale retailers who make most use of wholesalers.

(C) Stocks held by Government Trading Departments

20. These stocks are mostly valued at 31st March. In order to obtain the trend for the calendar year it was assumed that the physical movements proceeded at an even rate. The price changes adopted are derived from the Board of Trade wholesale price index re-weighted according to different categories of stocks held by each Department.

(D) National Coal Board Stocks

21. The estimates are based on fairly detailed information given in the N.C.B. *Report and Accounts for 1948.*

(E) British Transport Commission Stocks

22. The B.T.C. *Report and Accounts for 1948* gives end-1948 statistics of stocks but not end-1947 figures. Available evidence points to a rather small increase in physical stocks during 1948 and a rise of only 3—4 per cent. was therefore assumed. For inventory profits calculations it was assumed that (*a*) the rate of turnover of stocks is 4 months, and (*b*) the Board of Trade wholesale price index for industrial materials and manufactures is the appropriate index.

(F) "OTHER" PUBLIC CORPORATION STOCKS AND POST OFFICE STOCKS

23. The figures available on individual items in this group are rather sketchy, but the totals are unlikely to be far out. The rather large figure for the total increase in the value of stocks is due mainly to the effect the sharp rise in the price of cotton had on the stocks of the Raw Cotton Commission. Real investment in stocks, on the other hand, was depressed by the considerable reduction in raw cotton stocks.

(G) WOOL STOCKS

24. These stocks, which would normally be included in wholesalers' stocks, have been considered separately because of the substantial changes which have taken place both in physical wool stocks and in wool prices in the course of 1948. The estimates are based on the quantity figures given in the *Monthly Digest of Statistics* and on the official wholesale price index for wool.

(H) FARM STOCKS

25. Estimates kindly provided by the Ministry of Food.

(I) LIVESTOCK ON FARMS

26. Changes in the value of livestock on farms are not strictly analogous to working capital, but since they have not been included in fixed capital they should be taken into consideration. The estimates are based on the quantity figures given in the *Monthly Digest of Statistics* and on estimated increases in the "cost of production" of livestock.

MARGINS OF ERROR

27. Estimates of the kind attempted in this paper are not suitable for treatment by probability methods; there is, therefore, no satisfactory way of calculating margins of error. The following figures are mere illustrations of the effect on the final estimates, of changes in some of the basic assumptions; it is hoped, however, that these examples will give some idea of the magnitude of possible errors. At the same time it must be emphasised that on average expectations a good proportion of the errors should cancel out. An effort was made to find out whether there is any consistent

bias implicit in the reasoning on which the estimates are based, but none was found. The illustrations given below are confined to manufacturers' stocks which represented nearly 60 per cent. of total stocks:

(*a*) If one assumes the rate of turnover of manufacturers' stocks to be 4 months instead of 6 months, the increases in prices (applicable to the balance sheet quarterly values of stocks) between 1947 and 1948 are changed as follows:

	6 months	*4 months*	*Decrease*
March, 1947, to March, 1948	112.8	110.7	1.9%
June, 1947, to June, 1948	114.1	114.1	nil
Sept., 1947, to Sept., 1948	113.5	113.1	negligible
Dec., 1947, to Dec., 1948	110.4	108.9	1.4%

This would leave the end-1948 value of manufacturers' stocks practically the same.[1] The "change in the value of stocks" (£388 millions in Table II) would become £374 millions (a decrease of only 3—4 per cent.), but the effect on the change "due to price" and that "due to physical movements" would be appreciably greater: the former would fall from £200m to £169m (down 15—16 per cent.), and the latter would go up from £188 m. to £205 m. (up 9 per cent.).

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[1] It might be thought that changes in the price assumption (by definition) do not affect the estimate of the end-1948 value of stocks because whenever an assumption about the increase in prices between the same quarters of 1947 and 1948 is altered there is a compensating change in the corresponding estimate of "the increase in physical stocks," the total change in the value of stocks being left the same. It can be shown, however, that under certain conditions—which in the present case hold—the estimate of the end-1948 value of stocks based on a period of turnover of 6 months must be higher than the estimate which assumes a period turnover of 4 months. It will be remembered that the end-1948 value of stocks is arrived at by estimating what the value of stocks of each quarterly batch of companies would have been at the end of 1948; this is done by projecting the quarterly values for end-March, June and September to the end of 1948 along an estimated trend of physical stocks, and by adjusting for movements in prices between March and December, June and December and September and December of 1948.

Let B_1 and B'_1 represent the values of stocks of companies publishing balance sheets in the first quarters of 1947 and 1948, respectively, $I_1 \ldots I_4$ and $I'_1 \ldots I'_4$ the index numbers of physical stocks in the first, etc., quarters of 1947 and 1948, respectively, on the assumption that the rate of turnover is 6 months, and $i'_1 \ldots i'_4$ the same index numbers in 1948 with a rate of turnover of 4 months (the index numbers of physical stocks in 1947 are taken as given for both rates of turnover), $P_1 \ldots P_4$ and $P'_1 \ldots P'_4$ the index numbers of prices at which stocks were valued for balance sheet purposes in 1947 and 1948, respectively (rate of turnover 6 months), and $P_1 \ldots P_4$ and P'_1 and P'_4 the same index numbers (rate of turnover 4 months), X'_1 the estimated value of B'_1 at the end of 1948 (at end-1948 prices) on the assumption that the rate of turnover is 6 months, and x'_1 the same as X'_1 with a rate of turnover of 4 months: then $X'_1 = \frac{P'_4}{P'_1}\left(B'_1 \frac{I'_4}{I'_1}\right)$ where $I'_1 = I_1 \frac{B'_1 P_1}{B_1 P'_1}$, etc., therefore $X'_1 = \frac{B_1 B'_4 I_4 P_4}{B_4 I_1 P_1}$ and $x'_1 = \frac{B_1 B'_4 I_4 p_4}{B_4 I_1 p_1}$.

It will be seen that $X'_1 > x'_1$ provided $\frac{P_4}{P_1} > \frac{p_4}{p_1}$, which was the case.

The same reasoning applies to the other two quarters, except that the price ratios under the two assumptions were very nearly the same, which explains why the end-1948 value of stocks under the 6 months' rate of turnover assumption was only .7 per cent. higher than under the 4 months' assumption.

(*b*) A change in the assumptions relating to increases in physical stocks has similar effects on the final figures. Supposing, for instance, the increase between end-1947 and end-1948 to have been 11 per cent. instead of 9.3 per cent., and that between September, 1947, and September, 1948, 5 per cent. instead of 2.6 per cent. (and assuming the same rate of turnover of stocks, *i.e.* 6 months), the value of end-1948 stocks would be only 1 per cent. higher, but the "change in the value of stocks" (£388 m., Table 2) would go up by 8 to 9 per cent. The change "due to physical movements" would rise by as much as 18 per cent., but that "due to price" would be only 1 per cent. lower.

It will be seen from the above that alterations in certain assumptions leave the figure for the "end-1948 value of stocks" practically unchanged, but have a sizeable effect on the "change in the value of stocks", especially on the breakdown of the latter into changes (i) due to price, and (ii) due to physical movements. In the following example, however, all the figures quoted above would be changed in the same proportion.

(*c*) The adjustment which was made in order to take account of stocks of private companies assumed that stocks belonging to such companies were about 15 per cent. of total stocks. If the correct figure were 25 per cent. (instead of 15 per cent.) the end-1948 value of stocks would rise from £2272 millions to £2612 millions (an increase of 15 per cent.); at the same time the "changes in the value of stocks" (£388 millions), the change "due to price" (£200 millions) and that due to "physical movements" (£188 millions) would all increase by the same percentage.

28. It is only fair to say in conclusion that the estimates put forward in this paper are very rough. Some of the figures are relatively safe, *e.g.*, stocks of manufacturing firms which are public companies and Government stocks. Others, like wholesalers' stocks, are mostly guess-work. It will be possible to check several of the important figures when the results of

the Census of Production and Distribution Census become available. In the meantime it is to be hoped that research workers who know more than the writer about particular fields will make the necessary corrections. A good deal of painstaking work is still necessary before statistics of investment in stocks become dependable. Nevertheless, it may be said with some confidence that the results given here are at least of the right order of magnitude.

London.

A Note on Grants in Federal Countries

By A. D. Scott

The field of government finance in federal countries poses many problems, and there has recently been a revival in the flow of literature on this subject. The recent contributions of Professor Maxwell[1] and Mr. Birch[2] have emphasised that there exists a financial dilemma which is common to all federal nations.

There is, however, a further problem which has not been fully perceived in the existing literature. This further problem is essentially long-run in its nature; probably that is why it has been overshadowed by the short-run political and administrative difficulties which so beset attempts to systematise federal finances.

The dilemma of the federal nation can be sketched in a few paragraphs. It will be better understood if the vocabulary is first explicitly set forth. "Provinces" and "states" are used interchangeably to mean political subdivisions of a federal "country" or "nation". A "unitary" country or nation is one that is not broken down into provinces or states. A collection of neighbouring unitary countries is said here to form a "Balkan" area; a Balkan area could be transformed into a federal country by political union. Thus nineteenth-century Australia, the thirteen American colonies, and seventeenth-century India were Balkan areas for the purposes of this paper.

In every federal country there are some geographical areas where the average *per capita* income is lower than that in the other areas. Many factors help to account for these differences. In the literature on the subject they are generally subsumed under the heading of differences in resources—in some areas there are more resources *per capita* than in others—and the term is usually meant to include the advantages of transportation, ports, climate, drainage, and soil, as well as of deposits of raw materials. It also seems to include the possession of a stock of capital goods, and the head offices of financial corporations. Let us call the provinces located in areas of few resources *per capita* " poor " provinces.

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[1] Maxwell, J. A.: *The Fiscal Impact of Federalism in the United States*, Cambridge, Mass., 1946, esp. Chapter 17.

[2] Birch, A. H.: "Federalism and Finance", *The Manchester School*, May 1949, pp. 163ff.

It is implicit in the concept of federal countries that certain functions must be administered by the local authorities rather than by the central bodies. Responsibilities may be assigned after consideration of the comparative efficiency of the two layers of government, or of the historical, traditional, ethnic, religious, legal, constitutional and personal factors which apply in the particular case. Each province, charged with dispensing services to its citizens, levies its own taxes and sets its own standards of services. By contrast, in a unitary country, all functions of the government are handled by one central body which taxes all its citizens on any equitable basis thought suitable and dispenses the services of government on a uniform basis throughout the nation.[1]

In the " ideal " nation used as a model in the last chapter of Professor Maxwell's book, federalism poses no more problems than unitary concepts. In this ideal nation, the citizens, though heterogeneous, are so thoroughly mixed that each province is identical with its neighbours. In such a federal country it seems likely that each province would tend to levy the same burden of taxes and to provide the same bundle of government services *per capita*. However, when we turn to a situation closer to reality, we find that " poorer " provinces in our sense cannot levy the same tax *per capita* as the rich provinces ; for the low personal incomes in the poor states are by assumption the sole source of provincial government finance. In these poor provinces, the bundle of services distributed to the citizens must be correspondingly small.

The bundle of services distributed by the states consists of such types of personal assistance as health and hospital facilities, unemployment payments, family allowances, retirement and pension funds and subsidised utility enterprises. Such services are particularly important to poor people, who would be unable to provide their equivalent themselves. Thus, while the quantity of these services distributed *per capita* is less in poor states than in rich states, the *total* of amenities received by people in poor states is much less than in rich states, for in the latter the citizens, being richer, can provide amenities privately for themselves. Such differences in the total bundle of amenities received (living standards) is commonplace among the units of a Balkan area, where each country is left to stew in its own juice. But under federalism the continued existence of considerable differences in the amenities received by different sets of citizens is considered incompatible with nationhood.

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[1] This contrast is somewhat weakened in practice to the extent that municipalities and counties assume the rôles of provinces and states of a federation, and impose differing tax burdens, dispense different services, and receive different grants from the central government.

The literature of federal finance has undertaken to describe the difficulties which arise when a nation tries to augment the services received by the inhabitants of poor states. It has been shown that any method used violates one canon or another of desirable government conduct—for the central government must either relinquish completely the responsibility for the funds that it has collected, or else it must interfere to an excessive degree in the management of provincial affairs. The methods used involve the use of grants, either conditional or unconditional, or a compromise between them. In the final analysis they amount to a transfer of central government income collected in the richer states to recipients of government services in the poorer states.[1] Such transfers are typical of a large unitary nation, where little attention is paid to the geographical location of government collections and expenditures.

In addition to the difficulties of a theoretical and administrative nature which are present in every type of grant system, there is an objection frequently forwarded by politicians.[2] In often well-founded exasperation, they complain that the richer states, in contributing to the welfare and service costs in the poorer states, are subsidising inefficiency there. In such cases, transfers are undesirable in the same sense that a subsidy to a firm which would otherwise be beyond the range of normal profitability is a disservice to the efficient allocation of resources. In the literature, such complaints are rightly discounted, for the financial shortcomings of poor states cannot be explained by the ineptness of administration in a few of them.

It is the purpose of this note to point out that there is a valid objection, on the grounds of inefficiency, to making such transfers. This objection is that such transfers provide amenities to poor people in resource-poor states, a situation which may be undesirable in the long run for the following reason: the maximum income for the whole country, and so the highest average personal income, are to be achieved only by maximising national production. This in turn can be achieved only when resources and labour are combined in such a way that the marginal product of similar units of labour is the same in all places. An increase will result when labour is transferred from places where its marginal product is low to places where it is high; or, to put it another way, the intensity of the application of labour to scarce resources should be the same everywhere, in order to maximise production.

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[1] The question of tax-collecting efficiency will not be discussed here. This means that we neglect all problems arising from the transfer of funds collected by the central government in one area to the local government in the *same* area.

[2] Cf. Maxwell: *op. cit.*, pp. 392–393.

Such a labour transfer can come about in two ways. The first is by means of controlled labour allocation, either with or without the additional bribes of free transport to new places of work. The second results from the existence of real wage (amenity) differences between the two areas such that the worker can better his lot by moving to an area where the bundle of amenities received in return for his labour *plus* those received as a right of local citizenship is greater than the bundle in his former home. It is contended here that transfers of government income from place to place counteract this incentive to labour mobility and thus prevent the maximisation of national production.[1]

The reader may agree, yet suggest that a note on federal taxation is not the appropriate place to interject a plea to allow the natural law of classical economics to work itself out. The fact is that a federal nation is, in its simplest form, one of the best organisations for achieving labour mobility. In a unitary state it is very difficult to control the level of amenities provided to the people of specific areas. Thus, the government must provide to the farmers of the Outer Hebrides the same incentive payments to agriculture and the same mass of social benefits that it provides to the crowded midlands and the fertile rural areas. People in depressed areas are literally cared for in their homes. The real wage differential which might otherwise be an incentive to move to areas of relative labour shortage is weakened by the free provision of government services anywhere in the country.

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[1] This argument is correct only when stated in marginal terms, and in terms of similar units of labour. It is quite possible for the average product of labour in one province to be higher than in other areas, while the marginal product is lower. Such a situation occurs when the curve of average labour productivity falls very steeply as more men are hired—a curve which might describe a mining province of high average income for a certain number of men, yet of low marginal product when more men are present than can be used in the existing mines. The low marginal product, or unemployment, would drive them from the province of high average income to a poor province with a higher marginal product.

Again, it has been implicitly assumed here that all labour is of equal personal efficiency. If this assumption is relaxed, then labour of low productivity will tend to move to poor areas where the marginal product of labour is low, and find some sort of employment. The drift back to the farms during depressions is an illustration of this case, though it cannot be wholly explained by it.

In these two cases, the improved standard of life in poor provinces which results from federal grants will actually increase the national product by attracting labour from the richer provinces. There are, however, no general empirical reasons for believing that the demand for labour in rich states is so severely limited, or that the contribution of inefficient labour to the national product is actually being wasted by being applied in richer provinces.

I am indebted to Professor F. W. Paish for the points made in this footnote.

Things are different in a Balkan area. When the small country is overpopulated relative to other countries, it cannot transfer income from richer citizens. Thus the bundle of amenities shrinks as the resources disappear, and shrinks still further if the population grows, till emigration becomes obvious and sensible. At least part of the emigration from Ireland and the Continent in the nineteenth century can be explained on this basis. If, in this Balkan area, a confederation takes place, the labour mobility situation is initially what it was before the change, except that there are fewer physical and psychological barriers to migration to richer areas. But on the basis of history it can be predicted that an immediate arrangement will be made to grant transfer payments to the poorer states. According to Mr. Birch, the arrangement in Canada was on the principle of covering the provincial deficits of the poorer provinces—deficits which could otherwise have been covered only by raising the tariffs to very unpopular levels.[1] It should not be assumed that these deficits were the result of luxurious living or inefficiency. On the contrary they were to maintain services similar to those deemed normal in the rest of the new federation. Either higher taxation, or the lack of amenities privately provided will encourage labour migration. The tendency to transfer income to the weaker provinces has become stronger as the political power of the provinces has grown, and the tendency to move out of the deficit provinces seems to have become weaker. The more amenities that are provided in the poorer areas, the greater is the inducement to stay and multiply upon them.[1] And the poorer the people (under our assumptions, the greater the over-application of labour to resources), the higher the proportion government amenities are of total family income, and the less the attractiveness of higher real wages is elsewhere.

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[1] Birch: *op. cit.*, pp. 163–165. See also Copland, D. B.: "Problems of Federal Finance and Federal Grants in Australia", *Quarterly Journal of Economics*, May 1937, p. 497, where the problem of covering the deficit in the poor Australian states is reviewed.

There is little more to be said on this subject. It may be objected that maximising national production by increased labour mobility is a long-run end, while the usual discussion of federal problems is concerned with other, short-run, difficulties. This is true, and it is also true that mobility can be achieved by methods such as allocation which are not incompatible with federal grants to states. However, the proposals discussed by Mr. Birch and Professor Maxwell for income transfers are not mere stopgaps, but are recommendations for permanent policy, and as such will involve the drawbacks suggested in this note, of impeding the automatic tendency for an economy to allocate labour where it is most productive. We see evidence of this whenever an exasperated nation evacuates persons from an unproductive area, refusing to aid them to scratch a living in a wilderness or in a desert. However, if these persons are living in an organised political subdivision of that country, they are no longer evacuated to better land (or even left to their own devices) but are now the recipients of federal aid to their province or state on the explicit grounds that they have the misfortune (not the foolishness) to live atop an area that lacks resources or natural advantages sufficient to give them a standard of living equal to that in other parts of the nation. The deficiency of resources is not apologised for—it is flaunted as a signal to commence a flow of relief and assistance. It may be pertinent to point out that a federation of Europe would face the same problems as any federation : the contributions of the central treasury to the exchequers of the various components would vary directly with the poorness of the recipients.

(Of course, a new or young province can and often does make a sort of infant-industry argument, in which the " investment " of federal funds is justified on the basis that when readjustment has taken place, the local productivity will be as high as or higher than that found elsewhere. Such an argument must be assessed on its own merits, and nothing in this note refers to such a situation.)[1]

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[1] See, for example, the changes in provincial population shown on pages 41 and 46 of Canada : Department of Trade and Commerce : *Canada, 1949* ; and the figures on family size on page 46.

This note, then, differs from arguments for one or another type of grant chiefly in the end that it is desired to achieve: grants can be said to have various internal types of advantages such as efficiency, responsibility, directness, or cheapness. They also contribute to the short-run external advantage of freedom from want. But they achieve this freedom from want in such a way that the material end of a *federal* nation, which must surely be in these days the production of a higher income collectively than could be achieved on a fragmentary basis, is defeated. No country can make decisions about taxation and expenditure on purely economic grounds such as these. Still, it seems worth while to consider the long-run harm that may be done by fiscal devices selected for their administrative and political virtues.

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[1] Such an argument is implicit in the discussions of many writers on the federal question. See, for example, the first two reports (1933, etc.) of the Commonwealth Grants Commission, Australia, and the following articles: Bladen, V. W.: "The Economics of Federalism", *Canadian Journal of Economics and Political Science*, September, 1935, pp. 348–351; McQueen, R.: "Economic Aspects of Federalism", *ibid.*, pp. 353–355; Maxwell, J. A.: "Problems of the Commonwealth Grants Commission", *Economic Record*, December 1938, p. 190; and Wood, G. L.; "The Future of Federal Aid", *Economic Record*, December 1945, pp. 206–208.

Reparation Payments in Kind[1]

By Br. Suviranta

Theoretical discussion of the reparations problem after World War I was almost exclusively concerned with payments in money; little attention was paid to payments in kind, in spite of the fact that these played a significant part in the actual reparations programme. Thus, Germany was required to deliver to the Allies ships, railway equipment, livestock, and other movable property; coal, stone, bricks, tiles, timber, glass, steel, lime, cement, etc., i.e. materials needed for the physical reconstruction of the invaded areas. Indeed, it was this part of the programme that was carried out with some degree of success, whereas the payments in money proved a dismal failure.

This strange contrast between theory and practice finds its explanation in the view prevailing among the economists that, fundamentally, the method of payment was of little consequence, as all payments could ultimately be made in goods alone. Preference was, however, generally given to payments in money as being the more convenient method of payment. This view was expressed by Keynes, for example, as follows: " I see very little advantage, but on the other hand some loss and inconvenience, in the Allies receiving these goods direct, instead of Germany selling them in the best market and paying over the proceeds ".[2] A *negative* virtue was, however, attributed by some writers to payments in kind, namely that they would arouse protectionist sentiment within the creditor countries against the acceptance of reparation goods, and thus they would be helpful in reducing the excessive burden of reparations.

For the first time, perhaps, we meet with a clearly *positive* appraisal of payments in kind—as being preferable to payments in money—in the controversy between Keynes and Ohlin in the pages of the *Economic Journal* of 1929. Ohlin pointed out that even if monetary reparations of the magnitude then demanded from Germany were impossible, that would not prove that deliveries in kind of a similar size would also be impossible; on the contrary, he was himself of the opinion that, whatever the possibilities of monetary transfer, " there can be no doubt that deliveries in kind, i.e. an *organised shifting of demand*, can bring about an export surplus from Germany of the size and value envisaged in the Dawes plan ".[1] On this point, Keynes fully shared his opponent's view, though both of them were also convinced that such a solution was unfortunately not a practicable one.[2]

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[1] Part II of a public lecture on the " Dilemma of Reparations: Reparations in Money and Reparations in Kind ", delivered at the London School of Economics on May 11th, 1950.

[2] J. M. Keynes, *A Revision of the Treaty*, London, 1921, p. 175.

This exchange of views reminds one of Adam Smith's famous statement that " to expect, indeed, that the freedom of trade should ever be entirely restored in Great Britain, is as absurd as to expect that an Oceania or Utopia should ever be established in it ". Smith's Utopia materialised later, though he did not live to see it. The case was somewhat different with these two modern economists; only fifteen years later they were to become witnesses of " an organised solution of the reparation problem " on the lines envisaged by them, for in all the armistice treaties concluded in the autumn and winter of 1944-45 as also in the Declaration of Yalta, payments in kind were made the exclusive method of reparations.

The new system was hailed by its authors and supporters as solving the " vexed " transfer problem which had been regarded as the stumbling-block of the reparations system of World War I, in so far as it had been based on payments in money. And they were undeniably right in their claim that there would no longer be any transfer problem, for it is simply a truism that no obstacles can arise in the " marketing " of goods which the receiving country has explicitly undertaken to accept.[3]

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[1] Bertil Ohlin, " The Reparation Problem: A Discussion. Transfer Difficulties, Real and Imagined ", *The Economic Journal*, 1929, p. 178.

[2] J. M. Keynes, " A Rejoinder ", *The Economic Journal*, 1929, p. 182.

[3] This case is true only if the transfer problem is given a narrow interpretation, as is usually done; the case becomes wholly different if in the transfer problem be included *all* the repercussions in the trade between the two countries primarily concerned, or between them and any third country. Cf. for example, the revealing passage of Viner's: " Unless the payments received in kind represent imports of types of goods which are an addition to those which would come from any outside source in the absence of reparations, they contribute nothing to the solution of the transfer problem. They merely concentrate it on the non-reparations segment of Germany's trade relations with the outside world or shift its incidence to third countries. There is nothing in the inherent nature of payments in kind to facilitate the transfer of reparations ". (Jacob Viner, " German Reparations Once More ", in *Foreign Affairs*, vol. XXI, 1943.)

However, payments in kind present, instead of the transfer problem in the usual sense of that term, other and wholly different problems which need to be solved. They require accurate planning of the whole transfer as well as of every detail, and this planning must, moreover, fit into the prevailing economic order (or, conversely, the economic order must be made to fit into it) and also be in conformity with the particular system to be applied. For the truth is, though sometimes overlooked, that there is not just *one* system of payments in kind, but almost any number of systems. Such systems may be built upon the capital resources or the current production of the paying country. In the former case, the deliveries may take the form of dismantling of old plant, of taking over different kinds of movables, of transferring the ownership of establishments, etc.; in the latter case again, labour may be conscripted or a part of the annual produce sequestrated, and so on. All these types and combinations of them have actually been practised after World War II, and with varying success.

Time does not allow me to analyse all these different methods of payment. I must confine myself to a special case, that of Finland, which is one of the best recorded, for all reparation goods delivered by Finland to the Soviet Union, their cost for the Finnish government and their valuation are found in official accounts.

Finland's reparations were fixed in the armistice treaty of September, 1944, at precisely 300 million American gold dollars. This amount was to be paid within six years in 72 equal monthly instalments and entirely in kind. The goods to be delivered were divided into 199 specific categories. For a late delivery in any of these groups, a fine of 5 per cent. per month was stipulated, and consequently 60 per cent. per year on the amount in default.

The reparation scheme worked like clockwork; every time the hand of the clock passed a number on the face, one reparation month had expired, and when it had gone completely round the face, the whole programme was completed. The scheme had thus the appearance of being extraordinarily exact and symmetrical, and it was no wonder that some observers were greatly impressed by it. For instance, it was asserted at that time that " the burden of reparations will be a serious drain on Finnish resources, but justice demands that he who destroys his neighbour's property and endangers his life shall make some restitution. Anyhow, the sum is not impossibly high, and what is even more important, it is fixed and known.[1]"

I shall leave aside the question of justice, which is outside the sphere of economics, and draw attention primarily to the claim that the amount of reparations was " fixed and known ", for if that were so, it would be a special feature of payment in kind and would distinguish it from any system of payments in money where the real burden of reparations may be greatly altered, as a consequence of price fluctuations, from their nominal amount. I shall analyse in the following four cardinal points in the Finnish scheme : the pricing of the goods, technical requirements, composition of the list of deliveries, and the aftermath of reparations.

(1) *Pricing*. According to the armistice treaty the value of the reparation goods was to be expressed in American dollars, 35 ounces of gold a dollar, and, on the Finnish side, it was believed that the prices would be the *current* ones. It came therefore as an unpleasant surprise when the Russians later declared that *the prices prevailing in 1938* were to be taken as the norm for reparations. This was a highly disadvantageous norm for Finland, as the world market prices, measured in American wholesale prices, had gone up by about one-third since 1938. In the course of negotiations the proposed price norm was somewhat raised, but even so the reparations burden of Finland had been increased at a stroke by about 20 per cent. without any change in the nominal amount of the $300 million.

(2) *Technical Requirements*. In the execution of the reparation programme, such technical requirements for quality and equipment have frequently been demanded that the expenses in procuring the goods to be delivered have greatly surpassed the nominal prices originally fixed. Sometimes their costs of production have even been raised many times over, as may be exemplified by the wooden schooners, the price of which was fixed at 15,000 dollars each, whereas the cost of building them has amounted, in the average, to 180,000 dollars. This may have been one of the extreme cases, but the fact is that the technical stipulations in combination with the low price norm have raised the aggregate burden of the reparations at least by 50 per cent., i.e. from

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[1] R. R. Betts, " The European Satellite States " (*International Affairs*, Jan. 1945).

$300 million to $450 million according to 1944 prices. Calculated in prevailing prices, the margin between the " reparation dollar " and the real American dollar is appreciably greater, as may be seen from the fact that at the beginning of 1950 every " reparation dollar " cost the Finnish government approximately 630 marks or nearly three times the present official bank rate of 231 (which rate, it may be added, seems to have come at that time fairly close to the equilibrium rate between the American dollar and the Finnish mark).

(3) *The List of Deliveries.* In the case of reparations in money there need be no list of the goods to be delivered, and the task set for the debtor country is simply to try to produce such marketable goods as its industrial machinery is fit to produce, and to sell them on the most favourable markets abroad. Reparations in kind, on the other hand, must be based on a list of the goods required, but the composition of this list need not correspond to the economic structure of the paying country. It is, indeed, more likely to be adjusted to the needs of the receiving country.

Let me illustrate this conflict of interests by an imaginary example. Let us suppose that Great Britain has been attacked by Greenland and that the latter is defeated, a perhaps not quite unreasonable assumption. Let us further assume that the Eskimos are required to pay reparations in tea and bananas, the English being especially fond of these goods and not being able to produce them for themselves. The Eskimos who cannot themselves grow tea or bananas, and may not be able to acquire them from abroad, will, in that case, evidently be in default notwithstanding that they may be able to provide lard, furs, seals, and polar bears in value well up to the required nominal amount of reparations.

This was an imaginary case. But if we look up the list of goods actually demanded from Finland we shall find that there is only a difference in degree between reality and phantasy. Finland's standard articles of export have been timber and forest industry products ; during the decade 1929–38 actually 83·5 per cent. of her exports fell into this category. But these goods comprised only one-third of the reparations goods to be delivered. On the other hand, machinery and equipment covered 33·7 per cent. of the products included in the reparations list, whereas only 2 per cent. of the country's previous exports came under this group.

The list contained, further, new ships to be built, 20 per cent. of the total, and cable products, 8 per cent. of the total, the corresponding figures in Finland's ordinary exports lying close to the zero line.

Finland was thus required to deliver goods she had never exported in any such quantities, or not at all, and for which necessary plant, machinery, raw materials, and skilled labour were lacking. The only way out was to start to produce at home or to import the materials and machinery needed, to erect the new plant, and to train manpower for the new technical processes. That did not only utterly strain the limited resources of the country, but required time, and time was the most scarce of all commodities, as any default meant disaster. Before the end of the first year Finland was actually in default and the fines began to accumulate, and this in spite of the fact that forest products comprised one-half of the total deliveries under that special year, and the programme was thus technically easier to carry out. The deadlock was then solved through the extension of the reparation period from six to eight years, a valuable concession on the part of the Soviet Union.

(4) *The Aftermath of Reparations.* Before dealing with the aftermath, a short account must be given of the actual course of payments. Two years ago the nominal amount was suddenly reduced from \$300 million to \$226·5 million or by approximately one-quarter. No explanation was given why this was done, but this concession was, of course, thankfully accepted, as Finland's difficulties were thereby greatly alleviated. Of this amount, Finland had paid, at the end of 1949, \$185·2 million or 81·2 per cent.[1] The transport of the reparation goods from Finland to the Soviet Union had comprised over 300,000 railway carloads and over 200 shiploads. If all that transport had been made by train and all cars joined to one train, the length of that train would have been over 1,700 miles, i.e. all the way from Helsinki to London. For the management of this programme an administration office had to be established with a personnel of 520 people when it was at its largest. The cost of this bureaucracy should, of course, be added to the total burden of reparations.

The fact that Finland has, until now at least, been able to discharge her heavy obligation, is due to many co-operating factors: the preservation of social order, the enterprising spirit of the industrialists, the loyalty of labour, the ability of the planning authorities, and the material help received from friends abroad in the form of credits or direct humanitarian aid. If any of these factors had failed, the programme would have broken down. But even so, the burden was so heavy that inflation could not be avoided, as demands for continuous increases in wages and prices had to be conceded in order to keep the industrial machinery going all the time, with the result that the Finnish mark has now only about one-quarter of the purchasing power it had at the end of the war. Anyhow, there is a good chance that the rest of the reparation programme will be carried through within the prescribed term, i.e. before September 19th, 1952.

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[1] Till August 31, 1950, Finland had paid \$196.3 million or 86.6 per cent of the total.

But that is not the end of the story and now we come to the aftermath. The industries producing reparation goods have undergone a vast expansion; the capacity of the metal and shipbuilding industries is now more than twice above the pre-war level. And the question arises what to do with this increased capacity when it is no more needed for producing reparation goods? Where can the industry find an outlet for its products? In the West where it has to compete with old and well-established Scandinavian and English industries, and others as well? In the East, which, till now, has taken only about 20 per cent. of Finland's exports? In the home market under the cover of protective duties? Or must these industries be wound up with heavy capital losses and with mass unemployment?

This is the aftermath of reparations, and it is already being felt. Industry and government are at present tackling this problem. It must be hoped that it will be mastered as previously even more difficult problems have been mastered.[1]

The final judgment over the system of payments in kind must still be deferred, as the balance sheet has not yet been closed, either in the case of Finland or any other case. On the credit side of that system may be counted the solution of the transfer problem (in the narrow sense of that word), and also that more can, perhaps, be collected than by the rival mode of payment in money. On the other hand, a system based on payments in kind seems to be a very arbitrary system and it is doubtful whether an obligation payable in money leaves the real burden of reparations equally unsettled. Moreover, such a system can work satisfactorily only in a world-planned economy, or, preferably, world totalitarian economy. In such a framework perfect blueprints may be worked out, similar to that of the Finnish " clock-work ". Whether these blueprints also can be put with full efficiency into operation, is another question.

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[1] After the delivery of the lecture, a new trade agreement between Finland and the Soviet Union was concluded on June 13th, 1950. This agreement offers, for the next five years, at least a technical solution of the aftermath. The total turnover in the trade between the two countries is fixed for the period 1951-55 at 1450 gold roubles (equivalent to $350 million according to the official rate). Finland receives cereals, salt and sugar, tobacco as well as naphtha and other mineral products, etc., whereas her exports to the Soviet Union will comprise from 40 to over 70 per cent., varying from year to year, products of metal and shipbuilding industries, and besides mainly timber and forest industry products. The export and import prices shall follow world market prices. This agreement secures employment for the present reparation industries. Whether it also will be remunerative and give a return to the vast capital invested in these industries, is a question that only the future can answer. Anyhow, even after this the bulk of Finland's exports will go to the West, as this agreement covers only approximately 20 to 25 per cent. of her total exports.

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Devaluation and the Balance of Payments[1]

By A. C. L. Day

The intention of this paper is to circumvent some of the complications involved in the familiar approach[2] to the question of the effect on the balance of payments of a change in a country's exchange rate. In its simplest form this stability approach assumes that supply elasticities are infinite and trade is initially balanced. It then states that a small devaluation will result in an improvement in the balance of payments if the sum of the home elasticity of demand for foreign goods and of the foreign elasticity of demand for home goods is greater than unity.

The complication that elasticities of supply of traded goods are not necessarily infinite can easily be removed. The simplest way is that used by Haberler[3], where the concept of elasticities of demand for the *currency* of the other country is substituted for that of the elasticity of demand for the *goods* of the other country.

The derivation of the two elasticities of demand for currencies from Mrs. Robinson's four elasticities is as follows :

$$\epsilon_h = \frac{{}_g\eta_f + 1}{\dfrac{{}_g\eta_f}{{}_g\epsilon_h} + 1}$$

$$\epsilon_f = \frac{{}_g\eta_h + 1}{\dfrac{{}_g\eta_h}{{}_g\epsilon_f} + 1}$$

(where

ϵ_h = home elasticity of demand for foreign currency
ϵ_f = foreign ,, ,, ,, ,, home currency
${}_g\epsilon_h$ = home ,, ,, ,, ,, foreign goods

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[1] I am indebted to Professor Meade for valuable criticism in connection with this paper.

[2] E.g., Mrs. J. Robinson, *Essays in the Theory of Employment*, 1st edition, London, 1937, pp. 183–206.

[3] *Kyklos*, 1949, Vol. 3, p. 201.

$_g\epsilon_f$ = foreign elasticity of demand for home goods
$_g\eta_h$ = home ,, ,, supply of home goods
$_g\eta_f$ = foreign ,, ,, ,, ,, foreign goods).

Further complications arise when we remove the assumption that trade is not initially balanced. The most refined analysis of the problems arising here is that of Hirschmann.[1] There is no longer a unique stability condition ; instead, the conditions are different when we are considering stability in terms of home currency and when we are considering stability in terms of foreign currency. The critical sum of the elasticities will always lie within the range between 0 and 2, but in deciding exactly what it is, it is now found necessary to take account of

(*a*) whether we are concerned with stability in terms of home or foreign currency ;
(*b*) the initial proportional size of the gap between receipts and payments ;
(*c*) the absolute size of each of the demand elasticities. Where there is initial unbalance, and where the sum of the elasticities is such that after a change in the exchange rate the *absolute* size of the balance will remain unchanged, this position will not be maintained if one of the elasticities is increased by a certain small amount and the other is reduced by that same amount.

The stability conditions when there are payments fixed in terms of home or foreign currency can also be analysed by means of the Hirschmann technique. The intention of this paper is not, however, to follow these refinements further into the complications to which they give rise, but instead to ask a question different from that posed by Mrs. Robinson and Hirschmann. Instead of asking what are the conditions for stability, this paper asks what proportional devaluation is needed to *close* a given proportional gap in the balance of payments ? By putting the question in this way, we can derive a simple formula, on the assumption of curves of constant elasticities, which carries us beyond the elaborations and qualifications of the Robinson-Hirschmann solutions. At the same time, the question we are answering is one which is much more relevant to real situations.

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[1] *Review of Economics and Statistics*, 1949, Vol. 31, pp. 50–53.

It has, of course, been generally realised that the stability conditions may be satisfied while at the same time a very large devaluation may be needed to close a very small gap in the balance of payments (or of course to create a small favourable balance). There has been, however, little explicit consideration of the question, what are the elasticity conditions needed in order that the necessary devaluation shall not be excessive in relation to the balance of payments gap that it is desired to close? As a result, the current literature can be a little misleading unless approached with care. It is all too easy to think that all will be well if the Robinson-Hirschmann formulæ are satisfied.

The inadequacy of discussion solely in terms of the *stability* conditions is demonstrated by the fact that, assuming initial balance and that each demand curve for currencies is of uniform elasticity throughout the relevant lengths, it is only in the case where the elasticities of demand add up to unity that no conceivable alteration of the exchange rate can improve the balance. If the sum of elasticities is more than unity, then devaluation is needed; if the sum is less than unity, an upward valuation of the currency will improve the balance of payments.

It is true that such a movement could not occur in a normal foreign exchange market, and could only be operated with the assistance of exchange control. More seriously, it is true that such a policy would fly in the face of public opinion; it would, for example, have been difficult for the British Treasury to raise the dollar value of the pound if it had been thought in the summer of 1949 that the sum of the elasticities in the U.K.–U.S. trade was less than unity. More important still, it is true that the position of equilibrium reached by such a "perverse" movement of the exchange rate would be an unstable one, again in the conditions of a normal, free, exchange market. Nevertheless, it is theoretically possible for an omniscient government to attain and maintain any trade balance it wants, so long as the sum of the demand elasticities in the relevant range is not equal to some critical figure.

The question we have to answer is, given the two uniformly elastic demand curves for currency, and given the original proportional size of the gap, what is the proportional devaluation which will make the gap disappear?

The first problem that removes itself when we ask this question is the distinction between measurement in terms of home and of foreign currency. At *any given* exchange rate, the proportional size of the gap will be the same measured in terms of home or of foreign currency. Moreover, a devaluation which closes the gap in terms of home currency will also close it in terms of foreign currency.

The derivation of a formula to answer the question we have posed is a simple one to demonstrate. Let D be the number of dollars demanded by Englishmen for payments in America, P be the number of pounds demanded by Americans for payments in England, and r be the pound price of dollars. The two demand curves will be of the form

$$D = D(r)$$
$$\text{and } P = P\left(\frac{1}{r}\right)$$

If they have constant elasticities of demand then they take the forms

$$\left.\begin{aligned} D &= K_h r^{-\epsilon_h} \\ \text{and } P &= K_f \left(\frac{1}{r}\right)^{-\epsilon_f} = K_f r^{\epsilon_f} \end{aligned}\right\} \quad (1)$$

where ϵ_h is the English elasticity of demand for dollars, ϵ_f the American elasticity of demand for pounds, K_h and K_f being constants, showing the respective demands for dollars and pounds if $r = 1$.

Let P_0, D_0 and r_0 be the initial (disequilibrium) values and P_1, D_1, r_1 be the final values in equilibrium. Then from (1) we have

$$\left.\begin{aligned} K_h &= D_0\, r_0^{\epsilon_h} \\ \text{and } K_f &= P_0\, r_0^{-\epsilon_f} \end{aligned}\right\} \quad (2)$$

In equilibrium the English demand for dollars converted into pounds at the equilibrium rate of exchange is equal to the American demand for pounds, i.e.:

$$P_1 = r_1\, D_1$$

$$\text{From (1), } K_f r_1^{\epsilon_f} = K_h r_1^{(1-\epsilon_h)} \quad (3)$$

Substituting in (3) from (2), we get

$$P_0 \left(\frac{r_1}{r_0}\right)^{\epsilon_f} = r_0\, D_0 \left(\frac{r_1}{r_0}\right)^{(1-\epsilon_h)}$$

$$\therefore \left(\frac{r_1}{r_0}\right)^{\epsilon_f + \epsilon_h - 1} = \frac{r_0\, D_0}{P_0}$$

Changing the notation into a more convenient one for the final formulation[1], we have

$$(1+p) = (1+n)^{(\epsilon_h + \epsilon_f - 1)}$$

where n is the necessary proportional devaluation for bringing about equilibrium, and p is the initial size of the gap as a proportion of foreign currency earnings.

This formula helps to return us to conditions of simplicity from the complications into which the Hirschmann developments have brought us.

An important special case of the formula is where $(\epsilon_h + \epsilon_f) = 2$, as p will then equal n.

Very simple demonstrations can easily be given of three special cases where $p = n$, where straight lines or rectangular hyperbolæ represent demands for currency, on diagrams where the Y axis represents the £-$ exchange rate, and the X axis represents each country's demand for the currency of the other, measured *either* in terms of home *or* of foreign currency[2].

(1) Where measurement along the X axis is in pounds, and where the elasticities of home and foreign demand are both unity. The home demand curve will be a vertical straight line, the foreign demand curve a straight line through the origin. It is clear, by similar triangles, that $p = n$.

(2) Where the X axis again measures in pounds, $\epsilon_h = 2$, and $\epsilon_f = 0$. The home demand curve will be a rectangular hyperbola with co-ordinates the axes of the diagram; the foreign demand curve a vertical straight line. Again $p = n$.

(3) Where $\epsilon_h = 0$ and $\epsilon_f = 2$, and the X axis measures in dollars, we have again a case of a vertical straight line and a straight line passing through the origin.

Considerable simplicity is added to the discussion of the effects of devaluation if we use this formula instead of using the Robinson-Hirschmann stability formulæ. Firstly, as pointed out above, the question whether we are considering the gap in terms of home or of foreign currency becomes irrelevant. Secondly, the factor which controls the relationship of n and p is the *sum* of the two elasticities; if the numerical value of one elasticity is increased by a certain amount and the numerical value of the other is reduced by the same amount, no difference whatsoever is made to the relationship between n and p. Complications such as those considered above about the dependence of the size of the critical sum of elasticities on the relative sizes of the two elasticities do not enter. Thirdly, it can be seen that increasing the sum of the elasticities by a relatively small amount has a very considerable effect on the relative sizes of n and p. For example, if the sum of the elasticities is 3, then the necessary proportional devaluation will be *less than* half the proportional size of the original gap.

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[1] $\frac{r_1}{r_0} = (1+n)$ and $\frac{r_0 D_0}{P_0} = (1+p)$

[2] These diagrams are of the type used by Machlup (*Economica*, N.S., Vols. VI–VII, 1939–40, reprinted in *Readings in the Theory of International Trade*, pp. 104–158).

Some indication which may help explain these simplicities intuitively might be useful. The fact is, that we have no reason to expect the same complications as those that arise when we pose the stability problem because we are asking a different question. In the latter case we have two curves passing through two given points; the question is, what uniform elasticities will provide the condition that these curves will *be parallel* over a short range? Many pairs of curves will satisfy these conditions, but not all with the same sum of elasticities. If we make one of the curves less elastic by an amount x, then in order that the two curves shall remain parallel in the relevant range, we may have to add more or less than x to the elasticity of the other curve.

When we put the matter in the way suggested here, we are asking a different question. Given two curves passing through two points with the same value on Y, and given that the two curves are of uniform elasticity, at what value of Y will they *meet*? Now it is in the nature of such curves, that if the shape of the curves are altered, but the sum of their elasticities is constant, they will always meet at a given level of Y. Compare for example the cases where $\epsilon_h = 2$ and $\epsilon_f = 0$, and where $\epsilon_h = \epsilon_f = 1$, as represented on diagrams where the X axis is measured in pounds. Addition of one to the one elasticity and subtraction of an equal amount from the other does not alter the height above the X axis at which they will cut. (In each case the original points through which the two curves pass are unchanged.)

It is not the purpose of this paper to emphasise the practical applications of this formula. Limitations are, of course, imposed by the assumption of constant elasticity curves. Normally, for the lack of more detailed information, they are probably a reasonable assumption. But there are certainly cases when such an assumption would be highly misleading. Subject to such limitations and the duty of care which they impose, it seems that this formula provides a broad guide to policy and interpretation which is at the same time more simple than the Robinson-Hirschmann formulæ, and more realistic.

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A Note on International Commodity Agreements

By H. Tyszynski

At least since the great depression there has been a widespread consensus of opinion among economists, and among statesmen, that a solution of the problems of primary industries can be provided only on an international basis. The unsatisfactory experience of pre-war "producers' schemes", based on export quotas and a rigid allocation of market shares to particular countries[1], led to a number of new proposals designed to inject more flexibility into the mechanism of International Commodity Agreements.

Three major types of these proposals have received most attention :

(1) International Buffer Stocks[2].
(2) Flexible Multilateral Bulk Purchase[3].
(3) Commodity Reserve Money[4].

So far, only the second type of the new schemes has been put to the test of actual operation in the shape of the present International Wheat Agreement. A few months after its coming into effect it is too early, of course, to draw any "factual" conclusions. An analysis of all these proposals must, therefore, be limited to a comparison between the basic provisions of each of the schemes and an enquiry into their implications, as far as these can be ascertained in the light of existing knowledge.

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[1] Cf. P. T. Bauer : *The Rubber Industry* (1948) ; K. E. Knorr : *Tin Under Control* (1945) and *World Rubber and its Regulation* (1945).

[2] Cf. *inter alia* : P. Lamartine Yates : *Commodity Control* (1943) , pp. 223–228 ; L.o.N. (1945) : *Stability in the Post-War World*, Part II, pp. 265–271 ; E. S. Mason : *Controlling World Trade* (1946), pp. 145–147 ; O. Zaglits : " International Price Control Through Buffer Stocks ", *Journal of Farm Economics*, May, 1946.

[3] Cf. *International Wheat Agreement*, Cmd. 7680 (1949).

[4] Cf. *inter alia* : B. Graham : *Storage and Stability* (1937) and *World Commodities and World Currency* (1944) ; F. A. Hayek : " A Commodity Reserve Currency ", *Economic Journal*, June–September, 1943 ; J. M. Keynes : " The Objective of International Price Stability ", *ibid.* ; C. D. Calsoyas : " Commodity Currency and Commodity Storage ", *American Economic Review*, June, 1948.

I

The principal feature, common to the three proposals, is the absence of any " restrictionist " provisions, such as quantitative limits on exports or the fixing of relative shares in the market. Moreover, they cannot be branded as " producers' schemes " : not only minimum but also maximum prices are fixed, and thus they appear, at least *prima facie*, free from the shadow of the exploitation of the consumer. All these schemes attempt to eliminate excessive fluctuations in prices and incomes by means of enforcing a certain price range, within which complete freedom is left to the market forces and it is only when these limits are transgressed that the controlling mechanism comes into operation.

Unlike Multilateral Bulk Purchase, both Buffer Stocks and Commodity Reserves are based on the principle of storage operations by an International Authority ensuring that supply and demand are equated at prices neither higher nor lower than the agreed limits. On the other hand, there are two essential differences between these proposals: (*a*) while under Buffer Stocks price limits are fixed for particular foodstuffs or raw materials, the Commodity Reserve mechanism establishes minimum and maximum prices only for " composite units " of primary products ; (*b*) the Commodity Reserve scheme has far-reaching monetary implications absent from the Buffer Stock proposals.

As far as Commodity Reserve proposals are concerned, " composite stabilisation ", and not the monetary aspect of the scheme, is of primary interest for our present purpose. It ought to be stressed, however, that on its financial side the scheme does not necessarily imply rigidly fixed exchange rates on the gold standard model[1]. If launched in the shape of an " automatic " monetary standard, although far less deflationary than gold, it would still run the danger of hampering full employment policies, unless money wages were closely related to efficiency throughout the world, and major disequilibria in the balances of payments avoided. Commodity Reserves, however, can also be operated on the Bretton Woods pattern, under the authority of an International Monetary Fund, and with room for an " orderly " adjustment of exchange rates between national currencies.

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[1] Cf. B. Graham : *World Commodities and World Currency* (1944), pp. 102–103 and p. 175.

In this way the major objection to the scheme on the monetary side would be eliminated.

Multilateral Bulk Purchase, like Buffer Stocks, is based on the individual principle, i.e., it establishes minimum and maximum prices for particular commodities. Instead of focusing its mechanism on international storage operations, however, it relies on quantitative guarantees by individual countries which in the aggregate relate to some 50 per cent. or more, but not to the whole, of the estimated volume of trade between the participating countries. This gives the scheme a few formal, but nevertheless important, advantages over the " storage " proposals. While Commodity Reserves and Buffer Stocks can only be initiated in a period of relative abundance of primary commodities, Multilateral Bulk Purchase can be started even in a period of shortages. Moreover, the Reserve schemes and, with the exception of a few commodities, Buffer Stocks, require a well-established convertibility of national currencies on current account, but Multilateral Bulk Purchase is not similarly restricted.[1]

Owing to the prolonged monetary and political difficulties the world is facing at present, any general schemes for primary commodities, such as Commodity Reserves or a comprehensive network of Buffer Stocks, do not appear feasible for many years to come. It is proposed, therefore, briefly to underline the major differences between " composite " and " individual " stabilisation of prices of primary products, and then to compare " guaranteed quantities " and " international storage " as applied to individual commodities.

II

The Commodity Reserve scheme is an extension of Marshallian symmetallism. A composite unit, containing fixed quantities of some 15 or 20 commodities, is made convertible into internationally acceptable media of exchange (which may simply mean dollars). This is assured by an International Commodity Corporation which operates at fixed selling and buying prices with a ' free ' range of 10 per cent. between them. The quantities of commodities included in the unit are computed according to the relative importance of the selected goods in world trade and world production and their prices in a representative period. The actual transactions are performed by sales and purchases of warehouse receipts giving the title of ownership to specified amounts of composite units.

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[1] This does not mean, however, that this type of agreement is free from all financial difficulties. The " devaluation controversy " between the U.K. and Australia concerning the interpretation of the present Wheat Agreement is a case in point.

The effect of transactions in composite units on prices of individual commodities is largely determined by the fact that the International Commodity Corporation can buy or sell these commodities only in proportions fixed by the composition of the unit. If the price of the unit falls below the I.C.C. buying point, owing to a substantial decline in prices of some of its components, the support of these commodities will involve the raising of prices of all the remaining components of the unit, although their market position may actually be free from any disturbances. The proponents of the scheme stress that these " unwarranted " changes in individual prices would be spread over so many commodities that their effect would be negligible. It has recently been shown, however, that the scheme may have significant and undesirable effects on the pattern of cyclical fluctuations in incomes[1]. If the unit, as is suggested by the advocates of these proposals, contains foodstuffs along with industrial raw materials, then the support of the raw material prices during a trade depression will give rise to undesirable " windfall " gains to farmers, while an attempt to moderate steep rises of raw materials during a boom will equally make farmers suffer "windfall" and substantial losses.

Each purchase of a composite unit has the effect of raising the demand schedule for a component commodity, and each sale of lowering the supply schedule, but the number of such purchases or sales is determined by the facility with which the composite price adjusts itself to either of the set limits.

On grounds of the ordinary supply and demand analysis it may be said that the effect of these transactions on the revenue of producers of a given commodity will be the stronger :[2]

(1) the smaller the elasticity of demand for the commodity and, provided demand is inelastic, the smaller the elasticity of supply ;

(2) the greater its relative share in the unit ;

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[1] See C. D. Calsoyas : " Commodity Currency and Commodity Storage ", *American Economic Review* June 1948, pp. 349–350.

[2] I.e., the more advantageous when I.C.C. is buying, and the more disadvantageous when it is selling, composite units.

(3) the greater the elasticities of supply and demand for other component units.[1]

Thus "composite stabilisation" would cause direct and "unwarranted" changes in prices and incomes (i.e., unrelated to changes in costs or consumers' preferences) throughout the whole field of primary production. The adverse effect of Buffer Stocks on relative prices, on the other hand, would largely be limited, in the short run, to mixed farming and to those regions where "uncontrolled" substitutes in production (or alternative non-market uses for the "controlled" crops) were readily available.

Nevertheless, the Commodity Reserve mechanism would have several advantages over Buffer Stocks in the long run. It would tend to give greater security and stability to primary production as a whole and not to particular industries, and it would give effect to changes in relative demands as between different components of the unit without any adjustment of its composition or value. As a weighted average of a number of prices fluctuates much less than individual prices, it would also be less liable than Buffer Stocks to break-down due to stock exhaustion or excessive accumulation. Moreover, monetary possibilities of providing additional reserves of international liquidity should not be overlooked, although the fact that the major creditor nation is at the same time an exporter of a number of staple commodities limits these advantages considerably.

III

A comparison between Buffer Stocks and Multilateral Bulk Purchase can usefully be discussed if we clearly distinguish the major types of price movements that cause large-scale changes in incomes of primary producers. The respective advantages and disadvantages of both schemes, in the first instance, depend on the nature of the price movement in question.

While more permanent changes in price trends form a separate category, temporary price movements can be classified according to their three major causes: (*a*) cyclical fluctuations in demand; (*b*) recurrent variations in yield of agricultural crops; (*c*) exceptional shortages of the post-war type.

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[1] If these elasticities are low, then the volume of storage transactions necessary to maintain either price limit is relatively small.

Sharp cyclical fluctuations in demand are destabilising from the points of view of both producers and consumers. Buffer Stocks with their minimum and maximum price guarantees extended to the whole of trade in a particular commodity evidently provide the best remedy for such fluctuations.

Large-scale and recurrent variations in yield, on the other hand, give rise to price movements which to a certain extent are "income-equilibrating" from the point of view of producers. Owing to the inelasticity of demand for primary products, however, these price movements, if isolated from other influences, will tend to increase the incomes of producers in times of short crops far above their average level, and to lower them steeply below that level in times of bumper harvests. The extent to which Buffer Stocks could remedy the position would depend on the width of the "permitted" price range. A Buffer Stock scheme attempting to confine price fluctuations of an agricultural crop within ± 20 per cent. of an estimated long-run equilibrium level, would secure a "normal" revenue to producers in a given country only if market supplies in that country were 20 per cent. below or above average. But if these supplies diverged from the average by some 40 per cent. either way, the scheme would severely penalise producers in case of short crops, and lavishly over-compensate them in times of a bumper harvest.[1] It seems, therefore, clear that as far as producers' incomes are concerned, a "half-way house" between the free market and buffer stocks would tend to prove the best "stabiliser" against substantial annual variations in yield.

Subject to some important qualifications, Multilateral Bulk Purchase will here provide the required mechanism. If during a crop-year the market price is persistently outside the range fixed for guaranteed transactions under the Agreement, its mechanism comes into operation in directly affecting export (import) prices. To what extent, if at all, this change will be transmitted to producers and consumers will entirely depend on measures undertaken by the governments of the participating countries.[2] A host of different national devices to implement the provisions of the Agreement may result in a considerable, and probably undesirable, interference with the existing channels of allocating resources. What is desirable, however, are such measures in the exporting and importing countries as would result in passing on to farmers and consumers, respectively, the changes in price of the guaranteed volume of exports, induced by the operation of the Agreement, without substantially moving the price of the "free" exports from the level that would have obtained in the absence of the Agreement.

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[1] On the other hand, if the "free" price range were very wide, the storage mechanism would only exceptionally come into operation, and the whole scheme would in fact become an emergency measure.

[2] Cf. H. Tyszynski: "Economics of the Wheat Agreement," *Economica*, February 1949.

There is undoubtedly more than one way of securing this result. For the sake of illustration, however, the following example may be useful. Each exporting country institutes a Commodity Board which has a monopoly over sales abroad of the controlled crop and buys directly from farmers. It pursues a "passive" non-profit policy so that all its net revenue within a crop-year is passed on to farmers.[1] In the importing countries, on the other hand, the participating governments do not interfere with the market at all, and merely buy the guaranteed imports at the agreed price and resell them to merchants on the basis of highest bid. The resulting governmental profits in times of short crops, and losses in years of bumper harvests, are passed on to consumers through appropriate changes in general taxation.[2] For commodities with a completely inelastic crop-year supply ex-farm (e.g., cotton, sugar-cane or coffee) an average price below the free market equilibrium level would not reduce the quantity offered for sale. If, however, as in the case of wheat, there is an alternative non-market use for the commodity in question (e.g., feeding wheat to animals), some reduction in supplies in times of short crops would follow. This, however, is likely to be negligible, unless the short crop of wheat coincides with a short crop of maize, or some other important substitute in production. If the bad harvest does not extend to crops competing in feed use, the effect of these measures on relative prices will simply be to narrow down "abnormal" price margins in favour of the commodity under consideration, but not to eliminate them. It follows also that in these circumstances the changes in producers' incomes, induced by the implementation of the Agreement, would have no adverse effects on sowings in the following period; if anything, these measures would tend towards restoring "normal" price relationships between crops competing in production, which are disturbed, of course, by each "abnormal" harvest confined to one of them. As far as individual farmers are concerned, national crop insurance measures would still be necessary to provide assistance if their crops fall below a certain minimum.

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[1] E.g., a fixed advance may be paid at first, and the rest of the proceeds passed on to farmers when the whole crop is sold; the operations of the Canadian Wheat Board are a case in point.

[2] This method would not seem "unfair" in the case of a staple commodity in general consumption. If a system of indirect taxes and subsidies were applied instead, price control would probably be required in years of short crops.

From the point of view of the consumer, Buffer Stocks provide more income stability, but consumers' expenditure is much more diversified than even farmers' output, and thus the effect of a Commodity Agreement on fluctuations in producers' incomes is more significant. Moreover, "emergency stocks" in the importing countries can be instituted by the respective governments to protect consumers against the possibility of an acute shortage which could not be relieved by the release of ordinary commercial stocks. In any case, Multilateral Bulk Purchase, if implemented in the way suggested, would greatly reduce the effects on consumers' incomes of price fluctuations that normally obtain in a free market.

Thus, for commodities subject to large-scale fluctuations in yield, Multilateral Bulk Purchase appears preferable to Buffer Stocks. There is, however, an important qualification. If the commodity in question is produced mainly for the domestic market by an exporting country, then the guarantees will have little effect on aggregate producers' receipts; these will tend to approximate to the free market level, and ultimately Buffer Stocks may prove more stabilising.

If shortages were of a general nature, as during a post-war period of scarcity, both Buffer Stocks and Multilateral Bulk Purchase would exert a "disincentive" effect on the output of the controlled commodities as long as some important substitutes in production were left outside the scope of Commodity Agreements. This unfavourable influence would be much stronger under Buffer Stocks. Moreover, the danger of break-down through stock exhaustion—unless the upper price limit were frequently raised and the stabilising function of the Scheme almost nullified in consequence—indicates that international storage is not very suitable for exceptional conditions.

Apart from the trade cycle, the " weather factor ", and exceptional shortages, the major problem encountered by primary industries is the immobility of resources in face of a sustained downward price trend which results in structural maladjustments between supply and demand.

Whether these maladjustments are caused mainly by a falling secular trend of demand, or by rapid technological progress, or are inherited from a substantial expansion in response to war-time and post-war shortages, the ensuing problem of " excess capacity " cannot be solved by the price mechanism alone. It is usually stressed as the principal deficiency of Buffer Stock proposals, that the scheme is not well designed to facilitate adjustments required to follow the long-run trend in the basic conditions of demand and production technique. Not only is it next to impossible to find a satisfactory objective criterion for price-limit adjustment, but, moreover, any lowering of the minimum price sufficiently drastic to induce the required shift of resources would inflict hardships on producers similar to those inflicted by the market-price mechanism.

It seems evident that it rests with the government of the country concerned to speed up and smoothen the required transfer of resources with as much international assistance as possible. Although Multilateral Bulk Purchase also acts principally through the price mechanism, it seems by its very nature much more promising for achieving the aim of combining a protection to the incomes of producers with a strong inducement for the necessary shift of resources. There is no need under this type of agreement to lower the minimum price for guaranteed exports in order to make the forces of supply and demand exert their influences on producers' revenue and the balance of payments of the exporting countries. Prices of the non-controlled volume of trade in the commodity concerned will fall in accordance with the basic market forces. The governments of the exporting countries will be forced to deal with the " excess capacity " problem, while guarantees by the importing countries under the Agreement can provide the necessary international shield to protect incomes of the affected producers. The importing countries may agree not to press for a downward adjustment of the minimum price for the guaranteed purchases, provided they are satisfied that excessive high-cost capacity is actually being eliminated by a transfer of resources to other occupations. At the same time, governments of the exporting countries may make the passing of the benefits of the Agreement to the affected producers conditional upon their switching to alternative products or moving to other industries.[1] In this way the rigidities of a quantitative control of exports with shares in the market allocated to each country—advocated by the Havana Trade Charter as a " necessary evil " to deal with surplus capacity—would be avoided.

It follows from the above considerations that, as a rule, Multilateral Bulk Purchase can be more helpful than Buffer Stocks in providing a solution to problems of " excess capacity ". It constitutes also a better device for stabilising farmers' incomes in face of price fluctuations arising from extensive variations in yield of agricultural crops produced largely for export. Buffer Stocks, on the other hand, are particularly suited for primary industries where cyclical fluctuations in demand are the dominant influence and long-run structural maladjustment is absent.

In conclusion, it may be strongly emphasised that neither Buffer Stocks, nor Multilateral Bulk Purchase can prove a general solution for the problems of any group of primary commodities. Problems of each primary industry can only be considered on their own merits. A careful study and a comprehensive discussion must precede the signing of any Commodity Agreement. Ultimately, only actual experience of the working of an agreement can give sufficient ground for judging its particular provisions.

From an analysis of the broad principles of both proposals it is clear, however, that the " new look " in International Commodity Agreements provides important possibilities for an effective income stabilisation in the field of primary production without any serious misallocation of resources. And economic history of the inter-war years has taught us that this is one of the cornerstones of an expanding world economy.

Manchester.

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[1] It is realised, of course, that, as a rule, these measures will not be sufficient. In many instances, in particular in countries with very specialised production patterns, such as some sugar-exporting islands, foreign or international investment is absolutely essential to diversify output. But in any case the Agreement can prove very helpful to solve the problems involved.

Book Reviews

The British Journal of Sociology, Vol. I, Nos. 1–2, March–June, 1950. Edited by M. Ginsberg, D. V. Glass, and T. H. Marshall.

Professor Ginsberg has frankly remarked that the "groups of problems" with which sociology is concerned "have not been dealt with equally fully by sociologists, nor can it be claimed that sociology in its present condition is a systematic body of knowledge in which these problems are considered from a common point of view".[1] This is honest and true. But it should not be held against the new discipline. For, in fact, sociology in its absolute sense is beyond the present scope of the human mind. It aspires to be a synthetic corpus of knowledge; but it seems fairly obvious that the human mind, as so far developed, cannot yet evolve synthetic systems of knowledge at a scientific level. When we consider the imaginative simplicities and dogmatic adjustments of such synthetic generalisations as those of Hegel or Marx or Pareto, we may be thankful for their stimulus, but we must judge them as poetry rather than science. Today, however, when facts and statistics are at last becoming accurate and largely available, the food for scientific sociology is arriving. And, if we cannot hope for sciences of society at the highest level of systematic logical harmony, it is the more important that we should supply the grounds for natural growth towards this ideal through the efforts of many individuals. For only through the efforts of many individual thinkers and researchers can an atmosphere and tradition of synthetic social thought gradually develop. We have in fact for some time been conscious that the analytic social sciences, economics perhaps most of all, have travelled about as far as their analytic rails can carry them. The problem then, in the many departments of the social sciences that are growing in our universities, is to create the right agents to pull them together; to establish a constant means of and enthusiasm for mutual criticism; in sum, to nurse to manhood an individual and critical sociology. Only so, and very slowly, can such new processes of mind and interest establish themselves. For though we can always hope for the winds of genius, we cannot rely on them. And without genius, indeed even with it, the pace must be slow.

If this is so, surely a need is revealed for some kind of sociological journal in every university department of the social sciences; journals not necessarily or even advisably to be imposed on the public, but rather to encourage all the members of these federated departments to cross-fertilise their researches and reconcile their rather in-bred lines of thought. It is therefore at once a welcome and important event that we can salute a quarterly journal which we may confidently hope will act as a leader and model for all such lesser efforts in the sociological field. Our confidence is securely based on our knowledge of the three editors ; and readers of *Economica* especially will be grateful to them for the burden they have undertaken, and will wish them, with every warmth of friendship and informed respect, a rich harvest for their labours.

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[1] Bartlett and others, *The Study of Society*, *1939*, p. 437.

The British Journal of Sociology made its début in March 1950. Its first number accepts the awkward spread of sociology, and meets it, in the only wise way, with an admirable catholicity. In Raymond Aron we have the stimulating social philosopher testing the aphorisms of Marx and Pareto as to class distinctions by the rather harsh touchstone of recent French class tensions. This is continued in the second number in an exciting study of French class movements since 1945. (It may here suitably be remarked that the articles are not afraid to be topical. In analytic studies we are prone to limit our researches to the lines suggested by abstract thought. But " topicality " is surely to be welcomed in sociology, which has still to be built, and can only benefit from the impact of contemporary interests, so long as the treatment is scientific. How it fortifies us to learn from Leo Kuper (in Number 2) the real facts of racial balance in South Africa !) Then after the philosopher come suitably the morphologists—Professor Glass on population structure and Mr. Hall and Professor Caradog Jones beginning an objective analysis of classes and their movements ; and also the social psychologist, in Mr. Eysenck, on the subjective social attitudes behind our class structures ; and finally an historical excursion by Asa Briggs comparing the basis and quality of social leadership in the Lyons and Birmingham of the first half of the nineteenth century. This width of vision is supported by a bevy of clear, fair and informative reviews which can certainly serve as a model for future numbers.

This wide and proper balance in the first number we should regard as a model, but only one model. We may hope that further interests may be admitted. In particular it may be suggested that Education has a special claim. For specialisation has already perhaps tended to monopolise this fundamental sociological interest. It is therefore gratifying to find in the second number Sir Cyril Burt's review article on *The Trend of Scottish Intelligence* (Scottish Council for Research in Education). Here we reach the source of qualitative changes in the material of society. Thus far, however, the Journal has shown special interest in two vital factors in any sociology—social structure in classes, and the possibility of social control through research. Space imposes a general comment only on these two issues.

They can perhaps be generalised into a special concern for the *quality* of human societies. The concern with classes boils down to a compelling interest in what people typically want, and how and why they want it. Their wants and the reasons for them simply define the qualities which constitute their characters. This essential importance to sociology of quality, however, at once suggests two rather dogmatic reflections which underline the importance at present of such a Journal. First, we cannot expect positive exactness in such a sphere. *De gustibus non disputandum.* We must in the end be in the sphere of value judgments. But for such judgments we depend utterly on accurate facts—hence the precious value of such research programmes as that into class structures by Mr. Hall and Professor Jones.

Secondly, and of special import for economists, it appears that sociology may provide that new outlet for advance of which many have felt economics stands specially in need. The economics of the markets and accurate measurement of quantities by prices have to-day ceased to hold the centre of interest and importance. The reason may be that questions of mere quantities of " necessities " have, in theory at least, been largely solved. The stage is now captured by interest in the clashes of such " strategic " wants as leisure or new investment or defence ; synthetic omnibus interests, as against the single " analytic goods " of market economics. For the latter, the Invisible Hand of perfect competition might work well enough where there was no question as to the broad kinds of goods wanted. But as to the scope and forms of leisure or new capital and expenditure or defence, there is the widest and deepest debate as to what we want and why we want it. The ways in which we use our leisure, and the intensities with which we desire them, depend on what kind of people we are, on our ethical quality. Again, what kinds of capital goods shall be produced, after obvious needs are met, becomes the issue of high policy. In earlier stages free competition suffices, as it does adequately secure that the most efficient survive to satisfy wants about which there is no controversy. But once such wants become allied to the clashes of class interests or habits, only political processes, resolving social tensions in their crude way, can decide what shall be produced, what new possibilities shall be chosen. This, then, is the sphere of value judgments, of planning as a battleground of political parties, and of dynamic tensions in the movements of social classes.

In sum, economics is specially revealed to-day as only one aspect of any social theory, only one abstraction from the political and social processes, though a very important one. It is an aspect which has on its traditional somewhat narrow-gauge lines of thought been visibly coming to a rather dead end. And it will stay there so long as it fails to co-operate with and draw inspiration from the qualitative study of wants and social interests which should be supplied by sociology and social psychology. (The progress and lack of progress made in the theory of monopoly perhaps best illustrates this theme. Even statistics fails us here where we have no large numbers. Only a painfully slow study of actual business behaviour remains to us. But this is the method and substance of sociology.)

The suggestion by Professor Glass ("The Application of Social Research") that social research may help to fill this gap and guide these final strategic decisions is therefore specially relevant to the argument this review has suggested. As he says, "The fact that policy may be founded in part on value judgments does not in any way reduce the need to scrutinise its assumptions in the light of objective research. The question is how to ensure that there is adequate research, and that its results are taken fully into account."[1] In sum, who is to do this research testing for policy, and how is it to be made effective in political action as well as in the higher levels of social thought? For if a higher method is to become effective, it is essential that such research testing should spread through and dominate the whole social and scientific framework.

This review has tried to sketch the logic of the demand for an urgent development of sociology, simply because it seems specially urgent to-day to reveal rather precisely the need for wider social theories, the weaknesses they must inevitably exhibit, and the sympathy with which their inevitable gropings should be nursed. Our new *Journal of Sociology* is therefore indeed timely. As Professor Glass remarks of our contemporary scene, "There is at least more adventure". All will welcome this particular adventure. Especially we may hope that it may inspire similar flights of social research and cross-criticism in our social science faculties, and indeed wherever the organs and processes of our great but clumsy and explosive Leviathan are studied.

A. L. Macfie.

Income, Saving and the Theory of Consumer Behavior. By James S. Duesenberry. Harvard University Press (London: Geoffrey Cumberledge). 1949. pp. 128. 16s.

The failure of the American forecasts for the transition from war to peace has demonstrated that a re-examination of doctrine on the consumption function is necessary. Dr. Duesenberry's present book is a very interesting and useful contribution towards this.

The orthodox approach assumed consumption to be a roughly linear function of disposable income, with a positive constant term, so that below a certain level of income saving would be negative. Budget studies showing that rich families saved a larger proportion of their income than poor families, and regression analyses of aggregate data for the inter-war period seemed alike to confirm these ideas. The absence of any long-run rise in the average propensity to save was explained by a secular rise in the constant term due to increasing urbanisation, income redistribution and the introduction of new products.

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[1] Vol. I, No. 1, p. 28.

Dr. Duesenberry, however, claims that these and other trend factors have, in fact, not been sufficiently strong to offset the alleged tendency of saving to rise more than proportionately to income and puts forward the alternative hypothesis that the long-run aggregate average propensity to save is independent of income. He reconciles this with the evidence of the budget studies by arguing that the proportion of its income saved by a family depends not upon the absolute level of that income but upon its relative position in the income distribution.

The theoretical basis for these conclusions is given in the chapter entitled " A Reformulation of the Theory of Saving ", where it is argued that " the frequency and strength of impulses to increase expenditures for one individual depend entirely on the ratio of his expenditures to the expenditures of those with whom he associates " (p. 32). One reason for this is the " demonstration effect " : if one's associates spend more, one sees better quality goods and becomes dissatisfied with one's own cheaper purchases. Another reason is that a high standard of living is an end in itself and that one's standard is judged by comparison with that of others. What makes present consumption desirable, however, also makes future consumption desirable, so that the desirability of greater present consumption and of greater assets are both influenced by the magnitude of the expenditure of associates. It follows from this that as a person's income rises relatively to the income and expenditure of his associates, the pressure to increase current consumption will fall, while the pressure to increase assets will not, so that the proportion of income saved will rise. But if assets increase proportionately with income both pressures will decline in force. Since, in fact, the ratio of assets to income is greater in the higher income groups, Duesenberry's fourth conclusion on p. 45 that " Cet. par. the propensity to save of an individual can be regarded as a rising function of his percentile position in the income distribution " implies that as a person's income and assets rise relatively to those of other people, the pressure to increase consumption declines at a faster rate than the pressure to save more. This is the same hypothesis as in the orthodox theory of consumption except that it is the relative and not absolute magnitude of a person's income and assets that is of relevance.

The first conclusion on p. 45 that " the aggregate savings ratio is independent of the absolute level of aggregate income " is connected with the fourth, but can be reached independently. Suppose that a person's income, his assets and the expenditure of those with whom he associates all increase in the same proportion ; then an increase of his own consumption expenditure by that same proportion will bring him back to his original utility level on the assumption that the utility of consumption and assets depends entirely on their ratio to the consumption expenditure of his associates. If this is true of everyone, then total consumption will increase in the same proportion as total income and assets. It would follow that if, with a given income distribution, current income and expected future incomes from work rose while assets rose in a smaller proportion (i.e. with given interest rates expected future property incomes rose less) the proportion as well as the amount of aggregate income saved would increase.

In section 1 of Chapter IV, Dr. Duesenberry quotes a sample survey of income aspiration as confirming his hypothesis that people whose incomes are large in relation to the expenditure of those with whom they associate are more satisfied with their incomes. The survey showed that the higher the income group, the larger was the percentage of those questioned who said they were satisfied with their income, and the smaller the percentage increase in income required by those in that income group who said they were dissatisfied. But this seems to confirm his hypothesis only if the expenditure of the people with whom an individual associates is unrelated to his place in the income distribution. If " income is one of the principal status criteria " and " every individual tends to associate with other individuals of nearly the same status " (p. 30) then nearly everyone will be in contact with some people who spend more and so, on Dr. Duesenberry's hypothesis, nearly everyone will be dissatisfied with their incomes to about the same extent. Thus the survey seems to indicate that people judge their standard of living less by comparison with that of their associates than with reference to some more general ideal standard. This alternative hypothesis explains the long-run constancy of the savings ratio just as well if we suppose that the ideal standard rises with the actual standard of living. Furthermore, it is consistent with the greater average propensity to save of higher income groups (which Duesenberry's hypothesis is not, for if all are equally dissatisfied with their income and assets, all will tend to save the same proportion of their income). It is not inconsistent with the facts presented in section 2 of Chapter IV concerning negro and white saving, since as " we have in effect two separate communities " (p. 50) their ideal standards may be different.

It is generally assumed that a redistribution of income which decreases inequality will lower the aggregate savings ratio. As Dr. Duesenberry points out in section 10 of Chapter III, the interdependence of preferences brings this assumption into question, and with the aid of a numerical example he demonstrates that equalisation may raise the aggregate savings ratio. He supposes that a $5,000 ceiling (1941 prices) is placed on incomes, and that each family with that income saves the same proportion of it (25 per cent.) as did families receiving that income in 1941. When the point is reached where all families have $5,000 the aggregate savings ratio would then be 25 per cent. as against a past ratio in the neighbourhood of 10 per cent. This example is complicated by the assumption of a rise in aggregate income, so let us instead assume that a given aggregate income is redistributed so that everyone receives the same income, x. Analogously to Duesenberry we assume that everyone then saves the same proportion of their income as did families with an income of x prior to the redistribution. Then total saving will rise or fall according as that proportion is greater or less than the aggregate savings ratio was before the redistribution. The latter will be the case, however, because the proportion of income saved rose with income.

We could restore the savings-increase effect by bringing in Duesenberry's hypothesis (which he mentions but does not apply in this connection). As compared with before, most people will no longer have associates who spend more than they do and consequently they will feel better off, so that if the pressure to consume more falls more rapidly than the pressure to save more as relative income increases, the savings ratio will rise. On the other hypothesis of a general ideal standard, the savings ratio will fall unless the income redistribution directly affects that standard.

The first part of the book and the above discussion of it relate to the long-run behaviour of saving. In Chapter V, Dr. Duesenberry turns to its short-run behaviour. After an interesting discussion of methods of testing aggregative hypotheses by the use of micro-economic data, he argues that the consumption function is irreversible so that the savings ratio depends on the ratio of current income to previous peak income. His discussion is essentially the same as his important contribution to the Hansen Festschrift, and the conclusion is in agreement with the work of Modigliani (done quite independently) published in *Studies in Income and Wealth.*

Lastly, two other implications for economic theory of the interdependence of consumer preferences are considered. The first relates to welfare economics, and the discussion is as formal and no more useful than most highbrow welfare theory. The second is the problem of the growth of demand for new products. As Dr. Duesenberry points out, the vast expansion of the use of products such as washing machines in the 'thirties can hardly be explained by price and income variations or by autonomous changes in taste. He constructs a very neat model showing how a self-generating growth in demand may result from a lagged shift in people's preferences depending upon the actual purchases of other people.

This review is perhaps a little one-sided in that the bulk of the discussion has been devoted to Chapter III of the book, but enough should have been said to indicate that Dr. Duesenberry has made a stimulating and important contribution to the subject. It is only a pity that he did not add a further chapter surveying the discussion of the consumption function of the last decade ; such a chapter would have been extremely useful and the book would still have been a model of brevity. Perhaps Dr. Duesenberry will write this chapter for a second edition.

RALPH TURVEY.

The Distribution of Consumer Goods. By JAMES B. JEFFERYS and others. N.I.E.S.R. Cambridge University Press. 1950. xx + 430 pp. 35s.

" One of the most neglected tracts in the whole area of structural economic studies in this country is this field of distribution—it is still comparatively neglected, still—possibly owing to the absence of a Census of Distribution—largely unexplored. At the same time interest in it has grown " (p. v). This is the justification of Mr. Jefferys' choice of subject. His book, *The Distribution of Consumer Goods*, is a factual study of the methods and costs of distribution of consumer goods sold in the United Kingdom in 1938 and is based on information provided by a large number of individual firms, trade associations, producers, wholesalers and retailers, information that is collated in Part II, entitled " Case Studies of the Methods and Costs of Distribution of Commodities and Commodity Groups ". Part I summarises the information given in the individual case studies. Mr. Jefferys and the National Institute of Economic and Social Research are to be congratulated on producing a veritable mine of information on a subject of crucial importance. It is an extensive job most conscientiously done and no one interested in this subject can afford to pass it by.

Part I opens with a discouraging array of limitations on the certainty of the results. It is difficult for the conscientious research worker to relegate to the notebook the record of the doubts and difficulties he endured in reaching his final set of definitions and in surveying what appears as the almost infinite diversity of his material in its original crude form. It is a sign of Mr. Jefferys' intellectual integrity that so much of these preliminary agonies are included in the text. But it is overdone and, after all, the major implications of Mr. Jefferys' data are carried by percentages which are far from marginal.

After commenting on the " amazing variation in the estimates made " (p. 114) of the number of retail and wholesale outlets, Mr. Jefferys makes his own estimate (Chapter V, " The Structure of the Distributive Trades ") that the distributive trades in 1938 comprised 25,000—30,000 wholesale units or if wholesaler-retailers are included, some 50,000. There is no information concerning their regional distribution or turnover. Retail units (" fixed shops selling finished consumer goods ") number some 750,000 of which 66,000 were branches of multiple stores ; 24,000 branches of co-ops. and travelling shops ; 450 department stores and 657,000 unit retailers. Mr. Jefferys prefers the term " unit " to the more usual " independent " retailer because, he says, the unit retailer's " independence tends to be circumscribed ". We should like to hear more on this subject than the tantalising footnote just quoted (p. 22). In addition, there are some 250,000 service shops, hairdressers and the like.

In Chapter II the picture of the channels of trade stands out fairly clearly in the following terms : of total retail trade, 37 per cent. is conducted by co-ops. and multiples (i.e., stores with more than five branches); of this sub-total 14 per cent. comes from producers or importers who are linked with retail shops; 21 per cent. from other producer-importers; and only 2 per cent. goes through wholesalers. The implication is that it is not the co-ops. and chains who are employing the wholesaler but it is the "unit" shops. Of the 60 per cent. of retail trades conducted by the unit shop, 31 per cent. comes direct from the wholesalers, 6 per cent. from a second wholesaler, and 1 per cent. from a third wholesaler. Only 22 per cent. of the goods sold by the unit shop comes direct from the producer-importer. Clearly, it is the unit shops which depend on the facilities offered by wholesalers and we should not expect that pre-census data would yield sufficiently accurate information to go beyond this general conclusion to the subdivision of the middleman's functions.

Chapter II subject matter of "Factors influencing the Methods of Distribution", is highly controversial. But the author is at enormous pains to keep away from all controversial issues. They shall at best, be allowed to emerge through a table but the author himself expresses no opinions. Congratulations should, at this point, be offered on the excellently clear charts. One of these implies a direct correlation between resale price maintenance and the degree of concentration of manufacture; and again, an inverse correlation between resale price maintenance and trade via wholesalers. Yet, this central problem of the effect of resale price maintenance on the channels of trade and on the cost of distribution is dismissed in two pages with the frustrating conclusion, "Re-sale price maintenance also had an influence on the gross margin earned by wholesalers and retailers and in some cases may have led to higher or lower costs of distribution than would have been the case if wholesalers and retailers had been free to sell at prices dictated solely by the economic structure of these particular organisations" (p. 111). The very interesting estimate is given that, in 1938, 27–35 per cent. of all consumers' goods sold to private domestic consumers in the United Kingdom were re-sale price maintained (p. 112). Mr. Jefferys undoubtedly holds more constructive views than these, and one almost fears that in the course of his continuous discussions with traders themselves he has been led to abdicate a responsibility the reader would have preferred him to assume, namely that of independent critic.

Chapter IV deals with the "Factors influencing the Cost of Distribution." It opens with "Does distribution cost too much?" Mr. Jefferys is not going to answer the question. Indeed, he would prefer to show that the question itself is mistaken. He points to the difficulty attendant on attempting "to split a continuous physical and economic process (sc. production and distribution) into separate watertight compartments" and states that the "low or high total costs of distribution associated with a particular method of distribution are not necessarily a measure of efficiency or its opposite"; of course, because operating costs necessarily vary with first, the nature of the commodity, its perishability and the rate of stockturn and second, the nature of the distributive functions undertaken by wholesalers and retailers in relation to the commodity. But this is a somewhat negative conclusion: manufacturing costs and products also vary and in the field of manufacture also it is often difficult to attribute total cost between a number of " products ", yet we talk of efficiency and inefficiency in production. Mr. Jefferys estimates the distribution costs of producers at 5·4 per cent., those of wholesalers, importers and other intermediaries at 4·3 per cent., and those of retailers at 27·2 per cent. *of the retail price of the goods.* He gives, furthermore, a very tentative break-down between types of store: for goods sold direct to co-operative stores, multiple and department stores, producers' distribution costs appear to be of the order of 4·5 per cent. and the retail costs (including cost of wholesaling) 29–30 per cent. For goods sold through wholesaler to retailer, producers' distribution costs of 4–5 per cent.; wholesalers' costs of 9–9·5 per cent., and retailers' costs of 25–25·5 per cent. of the retail price are representative (p. 83).

After reading Mr. Jefferys' book we are left primarily with the feeling of an arduous piece of factual research very well done. " This volume is . . . confined to a recital of facts on the methods and gross margins of distribution . . . as information on distributors' operating expenses and net profits and on the nature of consumers' demand was not available, the material presented here can only be regarded as first statements of fact and cannot, by itself, be either a ' vulgar reflection on ' or an ' indication of ' the producers, wholesalers and retailers engaged in the production of their goods." Nevertheless, we regret the author's impersonality: could he not, for instance, have given his opinion as to the value to-day of a study of 1938 conditions, and his answer to the question—Does distribution cost too much and if so—why?

L. M. HALL.

Abondance ou Misère. By M. ALLAIS. Librairie de Médicis, Paris. 1946. 131 pp. Fr. 120.

This little pamphlet now bears the mark of time. But it also bears the mark of a courageous and most independent mind. At a time (1946) when most of the French public were convinced of the merits of a blind system of planning without prices, and the minority only asked for a return to the purest " laissez faire ", M. Allais proposed in this essay a policy of planning through the price system which was, unfortunately, bound to raise criticism from every quarter. Now that we are all liberal again, we feel perfectly at home in M. Allais' system, whose central thesis is roughly similar to that of, say, Professor Meade.

The first quarter of the book (pp. 12–36) is devoted to a destructive account of the erratic system of controls which the French economy had to bear at the time. The attack rarely misses the point, but it is sometimes overdone. It is only interesting in that it shows clearly M. Allais' emphasis on the efficiency and productivity of the competitive system as opposed to the waste of planning. But through this emphasis M. Allais unfortunately understates the strength of his case. Except by some scattered remarks, he fails to stress that the problem of efficiency is only one aspect of a more fundamental choice, and that the inherent mechanism of a policy of quantitative controls may well endanger, besides the efficiency of the economy, some values of a more fundamental order.

A summary of M. Allais' thesis and of his concrete proposals then fills two short chapters (pp. 36–48), and a thorough discussion of an impressive list of possible objections follows (pp. 49–103). The conclusions enumerate the advantages of the proposed policy. This plan gives the book a polemical flavour which adds to its pungency, but somewhat increases the dogmatism apparent in all of M. Allais' writings, and makes his thought appear superficial at times, which is exactly the opposite of the truth.

M. Allais' central thesis is that the competitive price system allows the maximum efficiency for the economy, but that, especially in periods of rapid structural changes, it leads to an inadequate and unjust income distribution. This is due to the existence of inflationary profits on the one hand, and of economic rents accruing to the owners of material resources and of stocks on the other hand. The proposed remedy is for the state to fix the prices of primary products and house rents at a level ensuring the equality of supply and demand, and to levy taxes on the producers and the house-owners equal to the difference between the new price and the former controlled price (minus 20–25 per cent. in the case of house rents, to compensate the owner for the increase in maintenance costs). In the same way, the interest rate would be left "to find the level corresponding to the action of supply and demand" (we are not told of what), and a tax on capital equal to the increase in the interest rate should be levied. The profits tax and income tax are condemned as immoral and dangerous by their disincentive effects. A part of the proceeds of the new taxes should be used to stop inflation (presumably through a budget surplus) and at the same time wage rates should be pegged at their existing level. The rest of the proceeds of the taxes (and the economies resulting from a careful pruning of government expenditure) should be used to distribute direct money allowances to compensate the lower incomes for the rise in prices. After a period of transition, a free market could operate again, provided there is effective state action against monopolies. The structure of taxes on capital, primary products and rents should be kept.

It is for the reader to judge whether these neo-Georgian taxation proposals are utopian or not. But, on some important points, one is left waiting for a further elaboration of M. Allais' position. Does he really believe that variations in exchange rates are always sufficient to equilibrate external payments (p. 40) ? That " neutral money " is a comprehensive recipe for economic stability ? That a strict pegging of wage rates is compatible with a policy aiming at a minimum of coercion (and if not, what of stability ?). There is no discussion of the distinction between private and public goods, nor of the rationality of public investment decisions and plans. But the main point is made that a competitive system is possible and efficient, and that it is compatible with a substantial degree of state intervention. It was important that this truth should be vigorously expressed four years ago.

Georges Rottier.

History of Economic Thought. Fourth Edition. By L. M. Haney. Macmillan Company, New York. 1949. xxii + 996 pp. 37s. 6d.

Hard on the heels of the new edition of its old rival, Gide and Rist, comes a new " fourth and enlarged " edition of Haney's History, first published in 1911, and long recognised as one of the most comprehensive, accurate, and clearly arranged works on its subject. Professor Haney has, probably wisely, not attempted to revise the earlier part of the book, which, of course, reflects the interest and judgments of 1911. For example, the long chapter on Malthus deals almost solely with his theory of population.

What Professor Haney has done is to add an extensive survey of developments down to 1948, bringing the total pages to just on 1,000, and introducing in so doing literally hundreds of names and titles. Certainly, the problems of arranging an historical survey of modern economic thought are baffling in the extreme, and any solution is bound to involve serious disadvantages from one point of view or another. Chronological order has, of course, to be abandoned to a large extent, and Professor Haney does this pretty thoroughly. But it is not clear what, if anything, he puts in its place, judging from a lengthy section on " Critics of neo-Classicism " ordered in the following chapters: " Business-Cycle Theory " (to Harrod), " Monopolistic and Imperfect Competition " (to Triffin), then Veblen, then Keynes, and then " General Equilibrium Economics " ; after which back to Roscher again to begin a final 150 page review by five main national " schools ".

A high standard of factual accuracy, which must be an essential virtue in such a book, is hardly maintained. (In this connection there is a slightly sinister tendency to describe as dead economists who are still, both biologically and intellectually, very much alive, e.g. Spiethoff (p. 673) and P. H. Douglas (p. 901).) It is good to find mentioned Uriel Crocker, the Bostonian, and J. A. Hobson (it would be fairer to describe Hobson as the English Crocker)—but his initials are given wrongly, and he is awarded to England.

As an example of Professor Haney's judgments we may quote the following passage describing the influences on Keynes' thought: "Other contemporary influences were the London School of Economics and the younger Cambridge group. King's College is in London and Keynes taught for a short time in the London School. This school was founded largely to counteract Classical economics. Its emphasis on institutional factors and on socialism seems likely to have had some effect upon Keynes" (p. 743).

It is only fair to say that this is not really a representative paragraph. Nevertheless, its surroundings do not—as they should—inexorably force one to the conclusion that it is simply the fruit of an amazing combination of printer's and typist's errors. Though grateful for the many useful references to be unearthed therein it is difficult to avoid the conclusion that the extensive new additions have rather spoiled a book, still useful, which has been of very great value in its day.

T. W. HUTCHISON.

Population Trends and Policies. A Study in Australian and World Demography. By W. D. BORRIE. Australasian Publishing Company, Sydney. 1948. xx + 263 pp.

The author intends his book to be a general text which may be used for the discussion of Australian population questions. Any discussion of these questions must take into account the experience of other countries and the trend of population in the world as a whole. Mr. Borrie accordingly begins his discussion with a carefully documented short account of the past trends and present demographic conditions in Europe and Asia. His subsequent analysis of Australian data shows how closely the pattern of demographic development in that country has followed that of Western Europe. There has been the same decline in the average size of the family, the same pattern of fertility differentials, and even the same rise in births during the second world war which the author is probably right in regarding as temporary. The situation is much the same as in Britain, but the consequences may be more serious for a nation like Australia which has reached her demographic peak at a relatively much earlier stage of development.

Mr. Borrie discusses the possibilities of a pro-natalist policy and sketches the attempts that have been made in other countries to raise the birth rate. He is most impressed with Swedish achievements in that field and outlines the modifications which he deems necessary to make Swedish policy applicable to Australian conditions. Mr. Borrie fully realises that the effects of pro-natalist policies have not hitherto been encouraging and he stresses the necessity for further research into this subject.

The subject of immigration is of special importance to Australia but Mr. Borrie's treatment of the problem is a little disappointing. He realises that Australian requirements for immigrants cannot be met by Great Britain and that migrants from elsewhere will have to be accepted. He seems to imply that the policy of excluding coloured immigrants may have to be abandoned, though he is understandably reticent about this subject.

Altogether the book is a useful summary and the parts relating to Australia in particular will be of interest and value to British students.

E. GREBENIK.

Indian Economics and Pakistani Economics. By B. B. GHOSH. A. Mukherjee and Co. Ltd., Calcutta. 1949. 612 pp. Rs. 10.

Mr. Ghosh has written a useful, near-up-to-date, account of economic conditions in India and Pakistan. He includes sufficient economic history to render the present situation intelligible, but deals in detail chiefly with the inter-war period, the immediate pre-war situation, and (much more superficially) the effects of the second world war on Indian economic life. He concludes each section with a brief account of developments, problems and policies, since partition, in India and Pakistan, respectively. An enormous field has thus been surveyed, and Mr. Ghosh deserves warm thanks for his collection and selection of facts and figures appertaining to almost every aspect of economic life in the Indian sub-continent.

It was hardly to be expected that a single individual could assemble, expound and interpret such a mass of data with equal success in all fields. If, therefore, the present review stresses imperfections this should be understood to signify not lack of appreciation of the task performed, but the hope that certain amendments may be introduced in subsequent editions, which would greatly enhance the value of the work.

In the first place there is not only no bibliography, but a striking lack of reference to sources, even for the many statistical tables that are reproduced. It was, no doubt, the author's wish not to encumber his narrative with a mass of footnotes. But political and constitutional changes in general, Partition and the absorption and amalgamation of the former Indian states in particular—to say nothing of the exigencies of war economy, and of the adoption and adaptation of machinery for economic planning—have entailed great changes in official records and statistics, and have been accompanied by innumerable special enquiries and reports. Books and pamphlets on current economic problems—of very unequal value—have emerged at a bewildering rate. The reader anxious to bring and keep his information up to date, or to pursue certain topics more thoroughly, will greatly regret the absence of guidance in this respect.

In the second place, may it be suggested that the time has come to jettison definitively, the obnoxious phrase " Indian Economics ", which suggests that because the social environment differs from one country (or area) to another, therefore economic reasoning must also differ. It need hardly be said that Mr. Ghosh himself conducts his survey in exactly the same way that he would if he had been dealing with a Western, or an economically advanced, country.

In the third place, it happens that (through no fault of his own) the author wrote at a period when it seemed that the disrupting economic effects of Partition were subsiding, and that rational economic relationships would prevail between these two countries whose economies are so essentially complementary. Since he wrote, and especially since devaluation, these relationships have seriously deteriorated, and trade has been brought to a standstill. Even if (as recent negotiations promise) improvement should again supervene, policies with long-term implications have already been adopted which—apart altogether from the losses involved by the present impasse—must prove economically deleterious. My criticism is not (of course) that Mr. Ghosh did not foresee future events, but that he has not sufficiently explained the difficulties inherent in the general economic relationship between the two countries, and has even glossed over the problems in particular spheres which existed apart altogether from recent events. He thus gives no hint of the possibility of " rocks ahead ", and the unwary reader may thereby be seriously misled. Even on the most optimistic assumptions it seems clear, for instance, that a trend towards greater economic self-sufficiency has been stimulated that will entail serious loss of efficiency and a great danger of over-capacity in the production of raw materials (such as jute) and of certain manufactures.

Space forbids detailed criticism of minor points, but it may be briefly mentioned that it is disappointing to find no estimates of (for instance) changes in rural indebtedness since the early 'thirties, or of war-time developments in industrial capacity ; that the treatment of banking legislation is disproportionately long, yet unilluminating —consisting, as it does, mainly of reproduction of the actual wording of this legislation ; that no adequate account is given of the war-time repatriation of capital (especially railway) assets ; and that the chapters on tariffs and public finance, by attempting to include too much detail, lack clarity. Nevertheless, in general the author's attitude is fair and sensible, and one feels that the defects in treatment arise chiefly from his praiseworthy effort to paint an up-to-date picture on such a wide canvas.

VERA ANSTEY.

SHORTER NOTICES

The Structure of American Industry—Some Case Studies. Edited by Walter Adams. The Macmillan Company, New York. 1950. x + 588 pp. 36s.

This book contains fifteen essays, all by different authors. Thirteen of the essays are devoted to particular American industries—cotton textiles, bituminous coal, agriculture, residential construction, steel, chemicals, cigarettes, motion pictures, fluid milk, tin cans, glass containers, ocean shipping and air transport. The two concluding essays deal respectively with public policy and organised labour in a free enterprise system. The editor, who is Assistant Professor of Economics, Michigan State College, has obviously gone to great pains to give the book coherence. Each industry study contains a brief historical section, an outline of the present institutional pattern, an analysis of market structure and price policy, and a discussion of the problems of public policy involved. The choice of industries makes it possible to illustrate and examine some of the problems of, for example, pure competition, oligopoly, duopoly, patent monopoly, Government subsidy and regulation. Some of the studies are very interesting indeed—well written and a nice balance of fact, analysis and argument—and the general level of the book is well sustained. It is addressed primarily to the student and " the intelligent layman " and an effort has therefore been made to avoid the use of technical jargon. In this country the book should prove useful to students who wish to compare and contrast the development, structure, policy and attitudes of British industries with their American counterparts.

L'Ecole de Lausanne. Textes choisis de L. Walras et V. Pareto. Edited by Firmin Oulès. Librairie Dalloz, Paris. 1950. iv + 431 pp. Fr. 800.

The Professor of Political Economy at Lausanne has prepared this volume of selections and commentaries in order to make better known and understood the works of the first two occupants of his chair. Neither Walras nor Pareto left their economic works in a form calculated to bring out to the best advantage their tremendous contributions. So praiseworthy is the object of this volume and so interesting and inaccessible much of the material it contains that any reservations or suspicions one is bound to have against any selections other than one's own are almost overcome.

This very useful volume tends to concentrate on Walras' and Pareto's views on the principles of economic policy, *laissez faire* and socialism, and much interesting biographical material is included. The purely analytic contributions of the Lausanne school are not extensively portrayed.

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